Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

HNOLOGY DEPT.

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DETROIT

COLOUR BY Courtaulds LIMITED

IMMEDIATE DELIVERY

CELLULOSE ACETATE MOULDING POWDER

EXTRUDED PRODUCTS

TRANSPARENT FILM

PLASTICS DIVISION: Little Heath, Coventry. Tele: Coventry 88031. 16 *St. Martins-le-Grand, London, E.C.1. Tele: Monarch* 8811

BX THERMOPLASTICS

in brief

PRODUCT	COMPOSITION	FORMS	PROPERTIES	TYPICAL USES
XYLONITE *Regd.*	Cellulose Nitrate	Sheets; Rods and tubes; Film; Solutions	Great toughness and rigidity. High transparency. Low water absorption. Good dimensional stability. Unlimited range of colours	Knife handles; Pens and pencils; Cycle pumps and mudguards; Drawing instruments; Cutting plates and bars
BEXOID *Regd.*	Cellulose Acetate	Sheets; Rods and tubes; Extruded sections; Film (also Tri-acetate); Solutions; Moulding powder	Tough and non-inflammable. High transparency. Unlimited range of opaque translucent or transparent colours	Lampshades; Optical frames; Toys; Packaging; Injection mouldings for industrial and fancy goods trades
LACTOID *Regd.*	Rennet casein	Sheets; Round and shaped rods; Tubes; Discs	Tough and non-inflammable. Wide colour range. Takes a brilliant polish	Buttons; Buckles; Electrical components; Furniture handles; Knitting pins; Pens and pencils; and Games counters
BX P.V.C. *Regd.*	Polyvinyl Chloride	Embossed sheet, rod tubes and injection moulding compound	Tough and resilient. Will not rot or perish. Acid and chemical-resistant. Waterproof. Good electrical properties. Unlimited colour range	Handbags; Belting; Upholstery; Shoe soling; Rigid and flexible tubing; Industrial aprons and gloves
VELBEX *Regd.*	Calendered P.V.C. sheet	Rolls 36″ and 48″ wide. 4/1000″ to 12/1000″ thickness	See BX P.V.C.	Rainproofs; Curtains; Fancy goods; Packaging
COBEX *Regd.*	Vinyl Chloride copolymers	Sheet	Dimensional stability; Good electrical and mechanical properties. Good chemical resistance. Non-inflammable	Deep draw mouldings; Slide rules; Lighting fixtures; Advertising and display
BX LAYFLAT TUBE	Polythene	Continuous lengths of tube in widths 2″ to 20″ and wall thickness of 1½″ to 5/1000″ or slit into sheets up to 20″ wide	Remains flexible in extreme cold. Water- and vapour-proof. Tasteless, odourless, non-toxic. Resistant to most acids and greases. Transparent	For protective packing of foodstuffs; Engineering and electrical parts; Chemicals; Tobacco and all general packaging
BX POLYSTYRENE	Polystyrene	Rigid sheet, rod, tube and foil	Low power factor. High volume resistivity	Electrical equipment, the foil is used also for packaging film
ISOFLEX *Regd.*	Layers of corrugated cellulose acetate film	Standard pads 24″ x 24″ Flexible pads 23″ x 20″	Low thermal conductivity. Extreme lightness. Non-inflammable. Non-porous and non-absorbent	Air conditioning and refrigeration insulation of all kinds; Ships; Rail and road transport vehicles, caravans
SARAN YARN	Polyvinylidene Chloride	Continuous monofilament. Diameters 10/1000″ to 15/1000″	Tough and flexible; rot-proof. Acid and chemical-resistant	Woven into Tygan fabric for hardwearing upholstery of all kinds. Also insect screens
BEXOL SOLUTIONS	Solutions of plastics in organic solvents	In liquid form	Various, according to purpose. Details on request	Sticking, staining, sealing, softening, laminating, dip-coating, spraying
BEXAN *Regd.*	Vinyl Resin	Brush monofilaments	Unaffected by water, acids and alkalis	Military hair brushes, ladies' and children's hair brushes; Clothes brushes

BX PLASTICS LIMITED

Higham Station Avenue, Chingford, London, E.4. *Telephone: Larkswood 5511*

"It's very easy"

says Mr. Bessant of Universal Tools.

. . . to play the "SELCOL HURDY GURDY" and it needs no skill or experience and very little effort to produce a tune.

You can't make moulds however, by just turning a handle, it demands a vast amount of skill and experience plus some quite elaborate plant. Even then if you want to make really good tools, you've got to add a real interest in a customer's project and I'm sure it is just this combination which has enabled us to tool successfully so many of the "tricky" mouldings you see around.

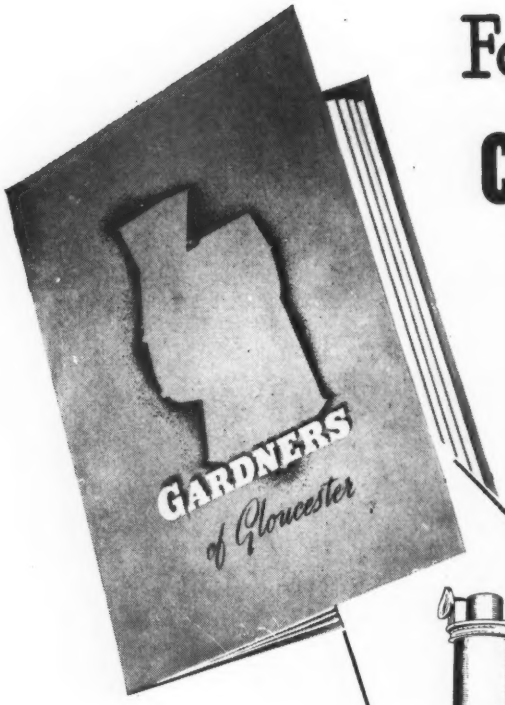
Fifteen different plastic mouldings are used in this attractive and tuneful toy, moulded by Thames Valley Moulders, Ltd., for Selcol Products, Ltd., on Peco 8-oz. injection machines.

It has a realistic tone and a repertoire of tunes is provided by means of the rapidly changed paper disc records.

UNIVERSAL TOOLS LTD.

TRAMWAY PATH, MITCHAM, SURREY.

Telephone: MITCHAM 1624



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The MOST MODERN RANGE of

POWDER PROCESSING

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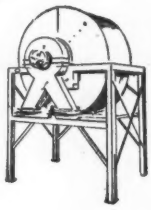
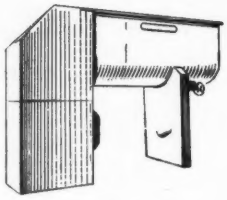
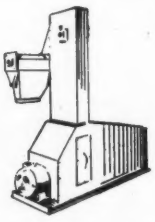
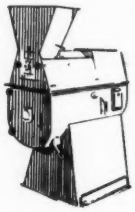
"RAPID" MIXERS, DRUM & VERTICAL MIXERS, SIFTERS, SIFTER/MIXERS, BLENDING, ELEVATING & SIFTING UNIT, DRESSERS, DRYERS, MILLS, etc. and SPECIALLY DESIGNED MACHINES FOR EVERY PURPOSE.









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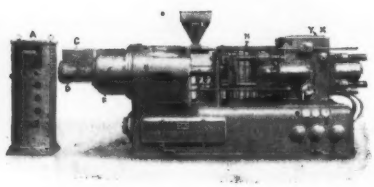
Our customers have the same feeling about the No. 9 Injection Moulder ——————such reliability, simplicity, and ease of operation that breeds confidence when giving delivery promises.

Oh, by the way—————————— you were quite correct in assuming that the No. 9 is a big factor in maintaining the Lorival tradition.

Maybe we could help you, too!

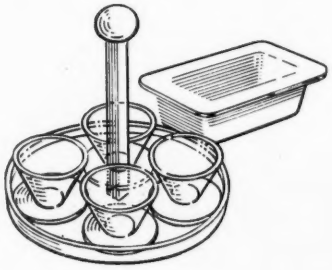


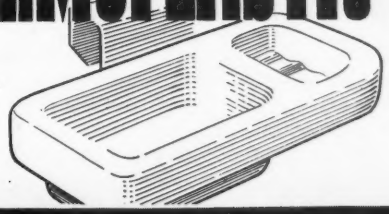
EMB No. 9 Injection Moulder

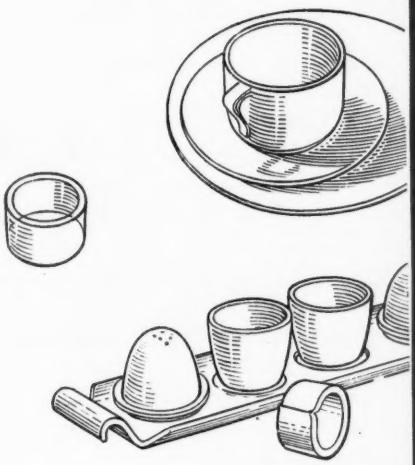
E.M.B. Co. Ltd.

WEST BROMWICH—ENGLAND

SOFTENING THERMOPLASTIC SHEET







BY

G.E.C.

INFRA RED LAMP PLANT

The softening of thermoplastic sheet prior to shaping can be carried out quickly and uniformly in G.E.C. infra red lamp plant without risk of the material becoming contaminated or marked. The plant is ready for use immediately it is switched on and can be switched off during idling periods. It does not waste energy in heating the surrounding atmosphere and ideal operating conditions are maintained.
The 12kW infra-red lamp plant shown is suitable for heating sheets up to 48″ x 36″.

Send for a copy of leaflet PH 1486 for full details.

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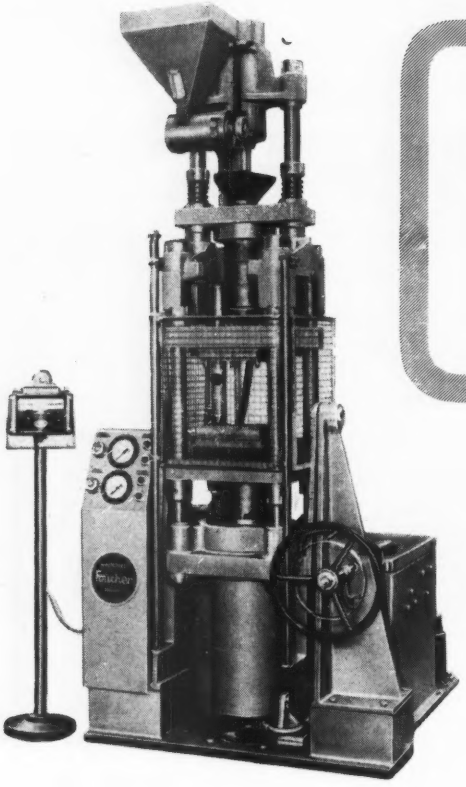
Easier Moulding

For the Plastics Industry



EARLY DELIVERY OF

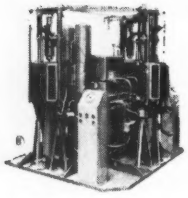
Foucher

INJECTION MOULDING PRESSES 30-500 Grammes

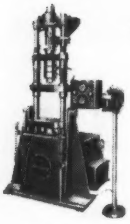
The introduction of the Foucher machines to Plastics Manufacturers has been met with great interest and the range has now been extended to the new 100 Gramme (Acetate) Vertical Press illustrated on the left.

This vertical-closing, four column press simplifies moulding of articles requiring metal inserts. Movable injection head enables offset-angle injection for special mouldings when required. Controlled automatic feed. Daylight between platens 400 mm., 20-ton injection pressure, max. moulding area 300 to 350 sq. cms. Like the other vertical machines very little floor space is required.

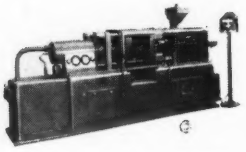
THE COMPLETE RANGE ALSO INCLUDES



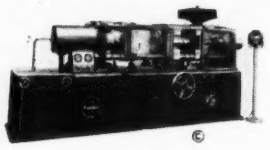
THREE 30 Gr. BATTERY
Self-contained battery of three vertical units served by one hydraulic unit. Each can be used independently. Working area 20-50 sq. cms.



50-60 Gr. VERTICAL PRESS
Injection pressure 15 tons, clamping pressure 50 tons. Effective working area 120-150 sq. cms. Speed of output 2-5 mouldings per minute dependent on tooling.



120-150 Gr. HORIZONTAL PRESS
Injection pressure 25 tons, clamping pressure 90 tons. Effective working area 250 sq. cms. High speed operation.



500 Gr. HORIZONTAL PRESS
Injection pressure 50 tons, clamping pressure 300 tons. Effective working area 1,000 sq. cms. High speed operation.

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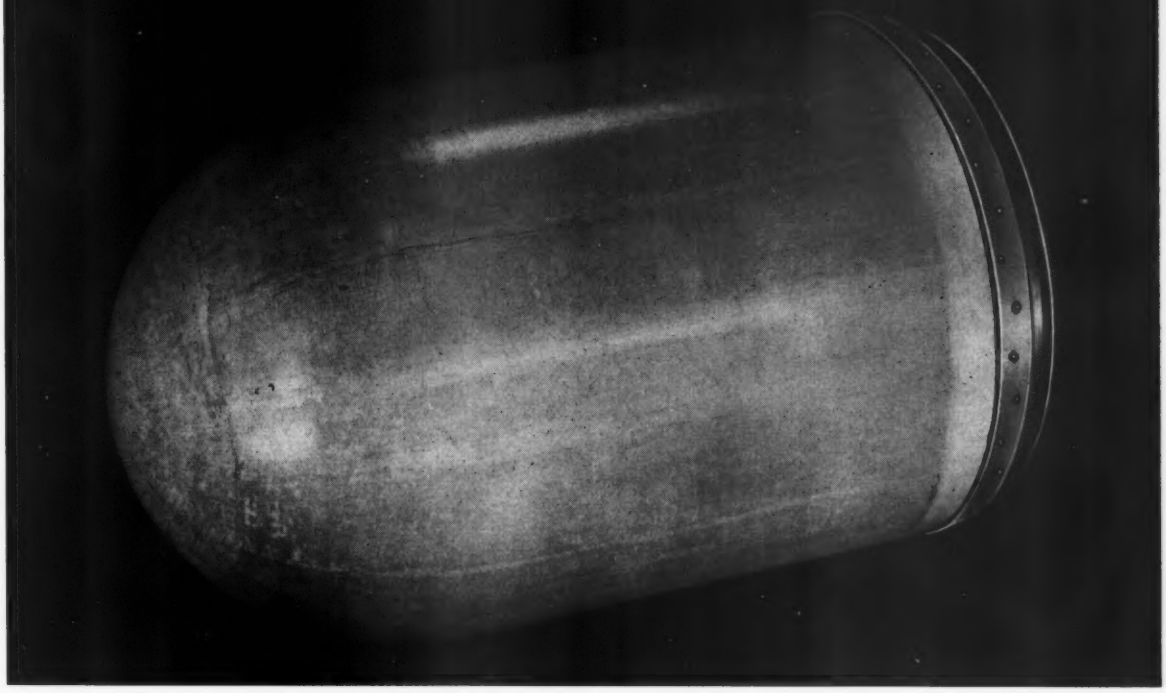

Illustration of radome we are at present producing.

We are the leading producers of Glass Fabric Laminates in this country and specialise in the manufacture of these in various grades both as standard lines and to customers own specification. We will be pleased to advise you on a suitable laminate for any application where strength and electrical or chemical resistance are of paramount importance.

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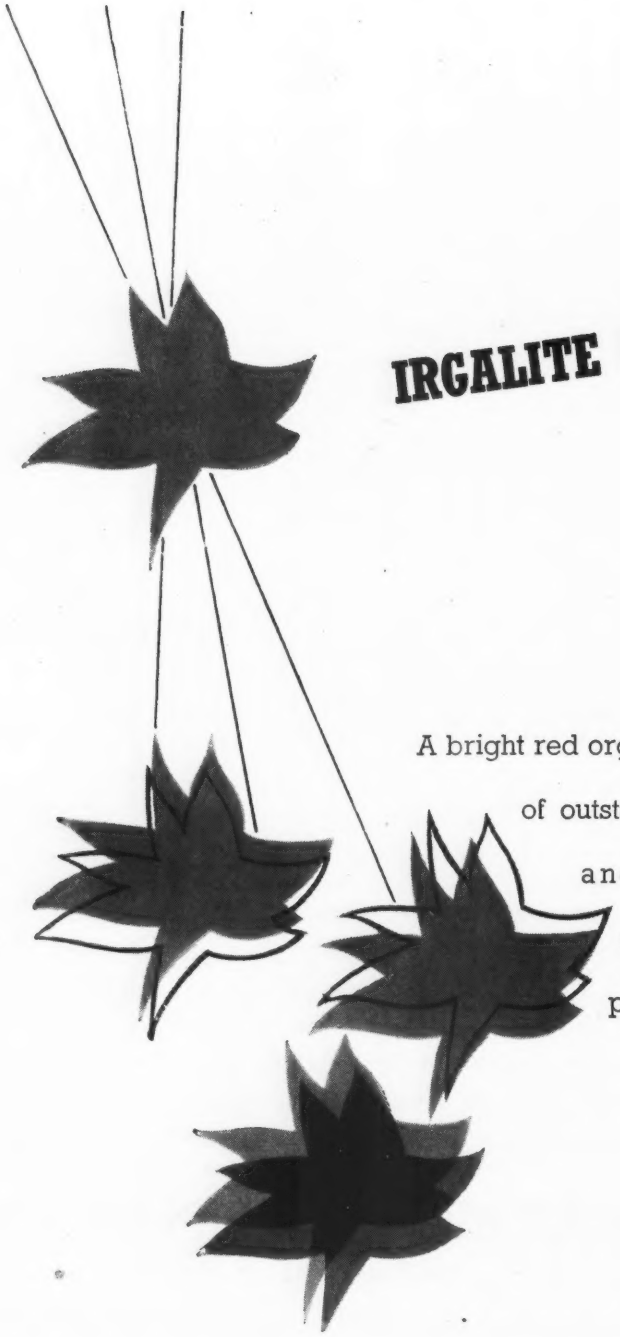

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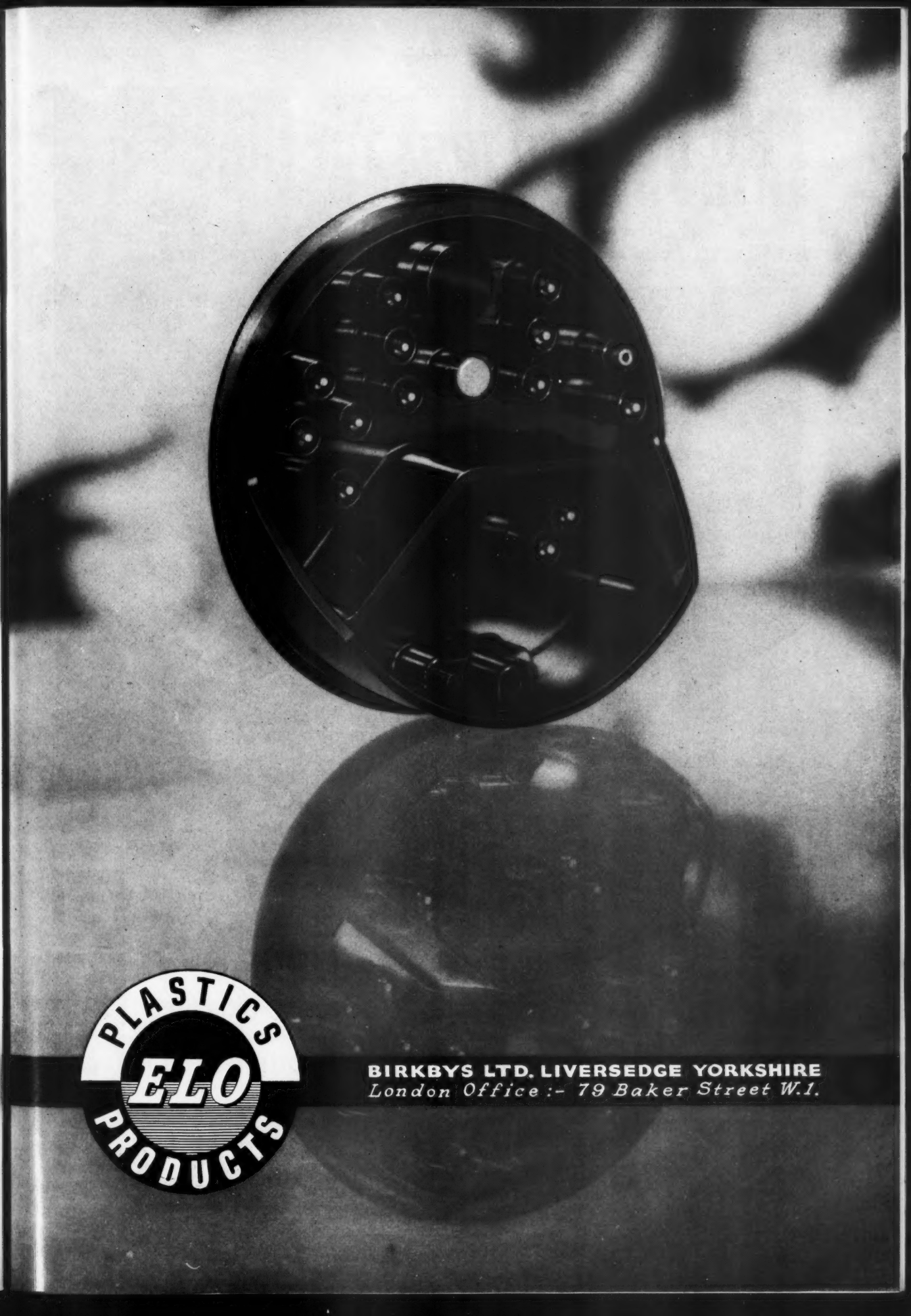
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HYDRAULICALLY OPERATED THROUGHOUT

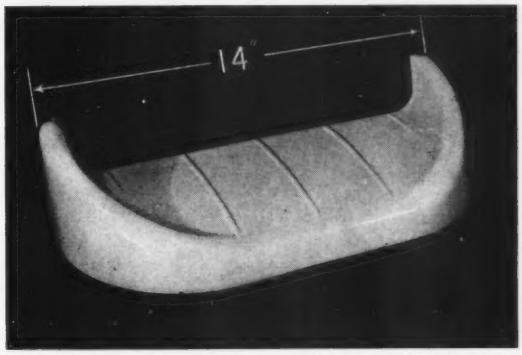
FULLY AUTOMATIC — SINGLE CYCLE OR MANUAL OPERATION

A hydraulically-operated machine for rapid production of high quality mouldings. Arranged for fully automatic, single cycle or manual operation. Driven by 20 h.p. motor. Locking pressure 250 tons developed on die-plates 21″ x 25″. Capacity 8 or 10 ozs.

A moulding with a maximum projected area of 100 sq. in. can be made.

We specialize in all types of machinery for plastics and also the design of dies and moulds.

Full particulars from Plastics Dept., Red Lane Works.



Photograph by courtesy of Messrs. Wilkins & Mitchell Ltd.

Polystyrene Washing Machine Tray—weight 9½ oz.—area 63 sq. in.—moulded for Messrs. Wilkins & Mitchell Ltd., The Green, Darlaston, Staffs. by the G.E.C. Witton, on a Herbert-Reed-Prentice 10D 10 oz. Machine.

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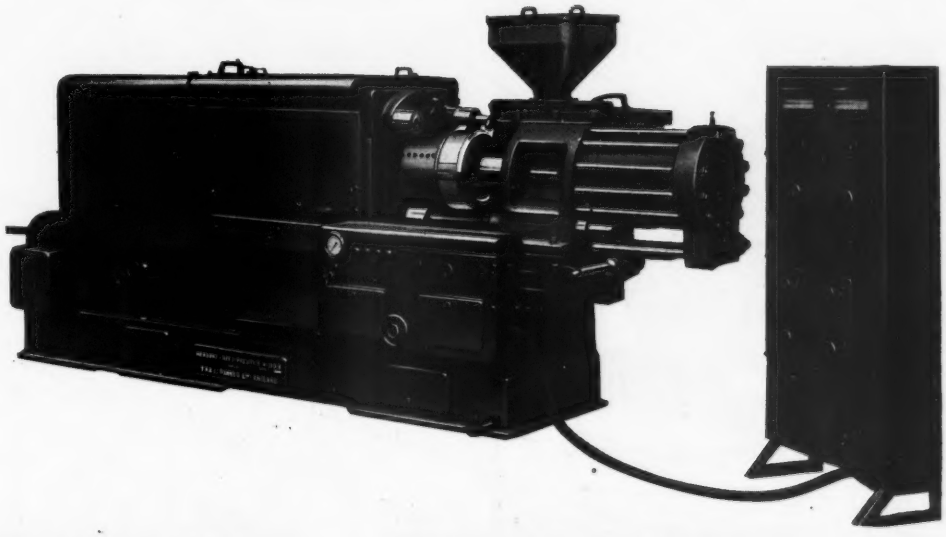

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Kopp Variators are available from
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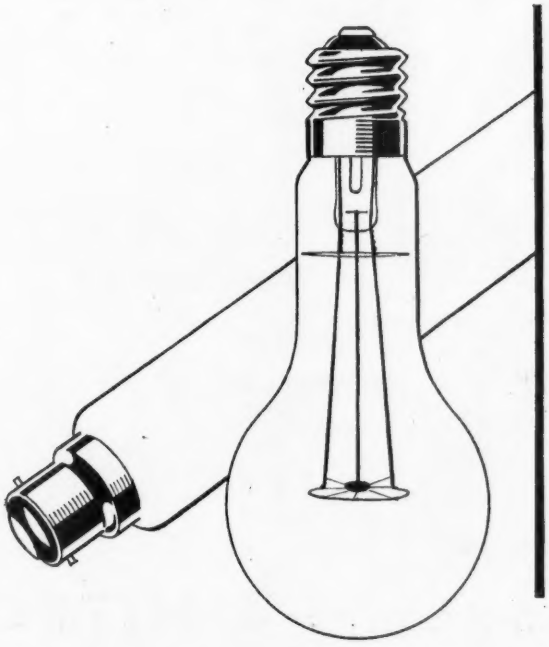
Crompton *LAMPS*

for every industrial purpose



Here's why

What you get out of a lamp depends on what is put into it. In Crompton lamps this means the best material, tested at every stage of manufacture and backed by lighting experience that spans nearly 75 years.

That is why you get full light output for a long life from Crompton lamps.

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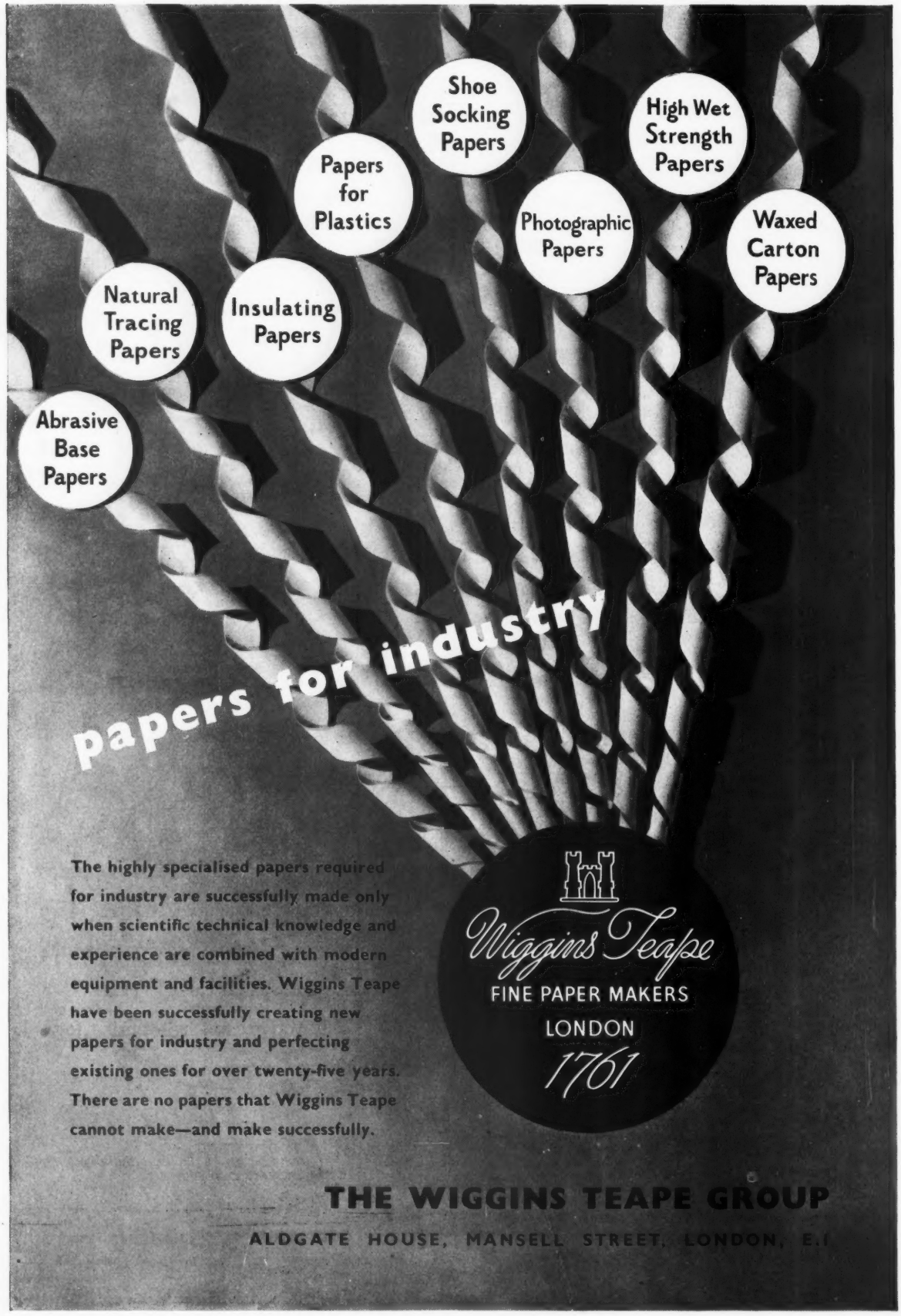
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Another example of "know-how"

THIS APPARATUS resulted from a successful collaboration between the customer and Lacrinoid. Certain components had to be transparent and tough and to have good insulating properties. The parts indicated by the symbol ◐ are those now being made by Lacrinoid.

Many industrial organisations have found Lacrinoid helpful in overcoming production problems created by shortages of materials once considered essential; plastics proving a most satisfactory solution. Lacrinoid is well equipped to deal with such problems, and by having its own tool making section is able to eliminate delays.

LACRINOID

TRADE MARK

FOR SPECIAL MOULDINGS OF COMPONENTS AND PRODUCTS FOR INDUSTRY

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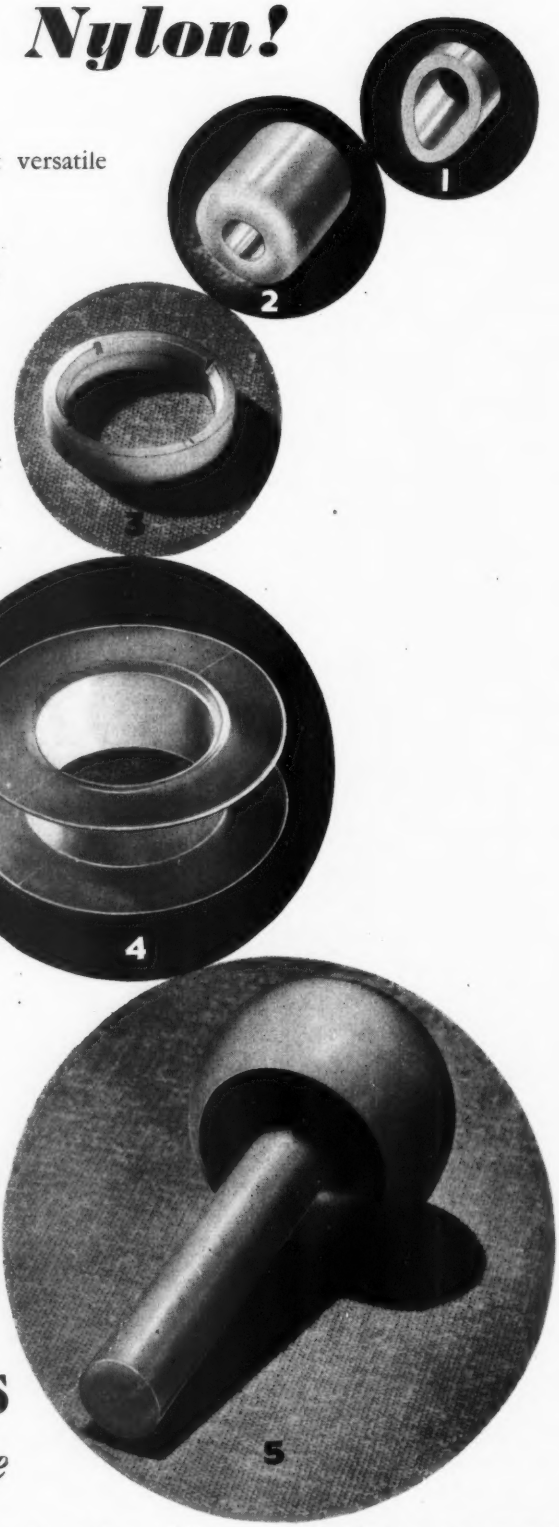
And now mouldings in Nylon!

It's good news because Nylon is one of the most versatile thermoplastic moulding materials yet developed. Everyone knows about Nylon fabrics, but did you know about moulded Nylon piston rings? Or gears and bearings? Or hypodermic syringes? Nylon is being used for all these widely varying articles—and for countless others.

Tough, resilient, with exceptionally high impact strength—quickly-moulded Nylon will make possible hundreds of new applications in every field of industry. And at the moment we are only skimming the surface. Nylon's durability, low friction coefficient, and self-lubricating properties, open up all sorts of exciting possibilities. And for a thermoplastic material it has very high heat resistance — it can be sterilized and is non-toxic. Why not come and discuss Nylon with us? It's worth talking about.



1 ***Cams and gears.*** Nylon is very useful tor small moving parts like these. Quite apart from the ease of manufacture, Nylon is light, very durable, and will stand up to years of wear. For smaller quantities, blanks can be supplied from stock.

2 ***A refrigerator latch roller.*** Every time the door is slammed this roller takes the shock — a moving part that never needs oiling.

3 ***Piston rings.*** Nylon piston rings control the flow of fluid in hydraulic shock absorbers. Unaffected by abrasion or the maximum temperature involved, they will easily withstand the greatest pressure built up.

4 ***Coil winding bobbins.*** Nylon's resilient strength makes possible these thin flanges which take up and hold a strain that would crack more brittle materials.

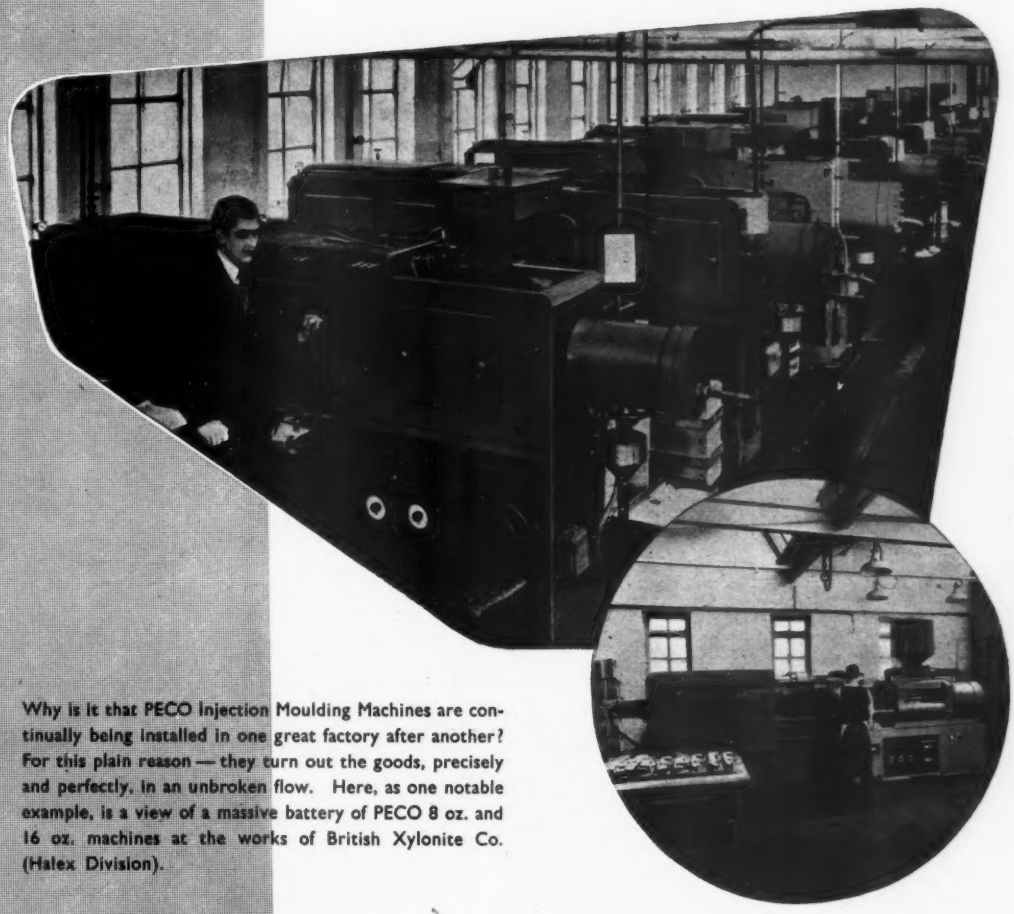
5 ***This artificial hip-joint*** has been developed in collaboration with a well-known orthopaedic hospital.

FRASER *and* GLASS

the plastics people

Fraser & Glass Ltd., Woodside Lane, London, N.12 (Hillside 2224-5)

And Why is It Happening?



Why is it that PECO Injection Moulding Machines are continually being installed in one great factory after another? For this plain reason — they turn out the goods, precisely and perfectly, in an unbroken flow. Here, as one notable example, is a view of a massive battery of PECO 8 oz. and 16 oz. machines at the works of British Xylonite Co. (Halex Division).

MOULDS

PECO MOULDS. Expert designers and mould makers are employed and moulds can be supplied to samples submitted, including die-sinking models if required. An important side of the Company's work is the hobbing of cavities for moulds and medallions — the plant includes a 3,000 ton hobbing plant. Master hobs to customers' samples made as required.

PECO Injection Moulding Machines are supplied in 2, 4, 8 and 16 oz. capacities. They are self-contained with automatic cycle and are hydraulically operated. They have a high plasticising capacity and rate of injection. Mould-locking pressure and platen area enable them to operate at a high rate of production.

Full particulars of the PECO range of Injection Moulding Machines and Moulds will be sent on request.

PECO PRODUCTS

The PROJECTILE & ENGINEERING COMPANY LTD.

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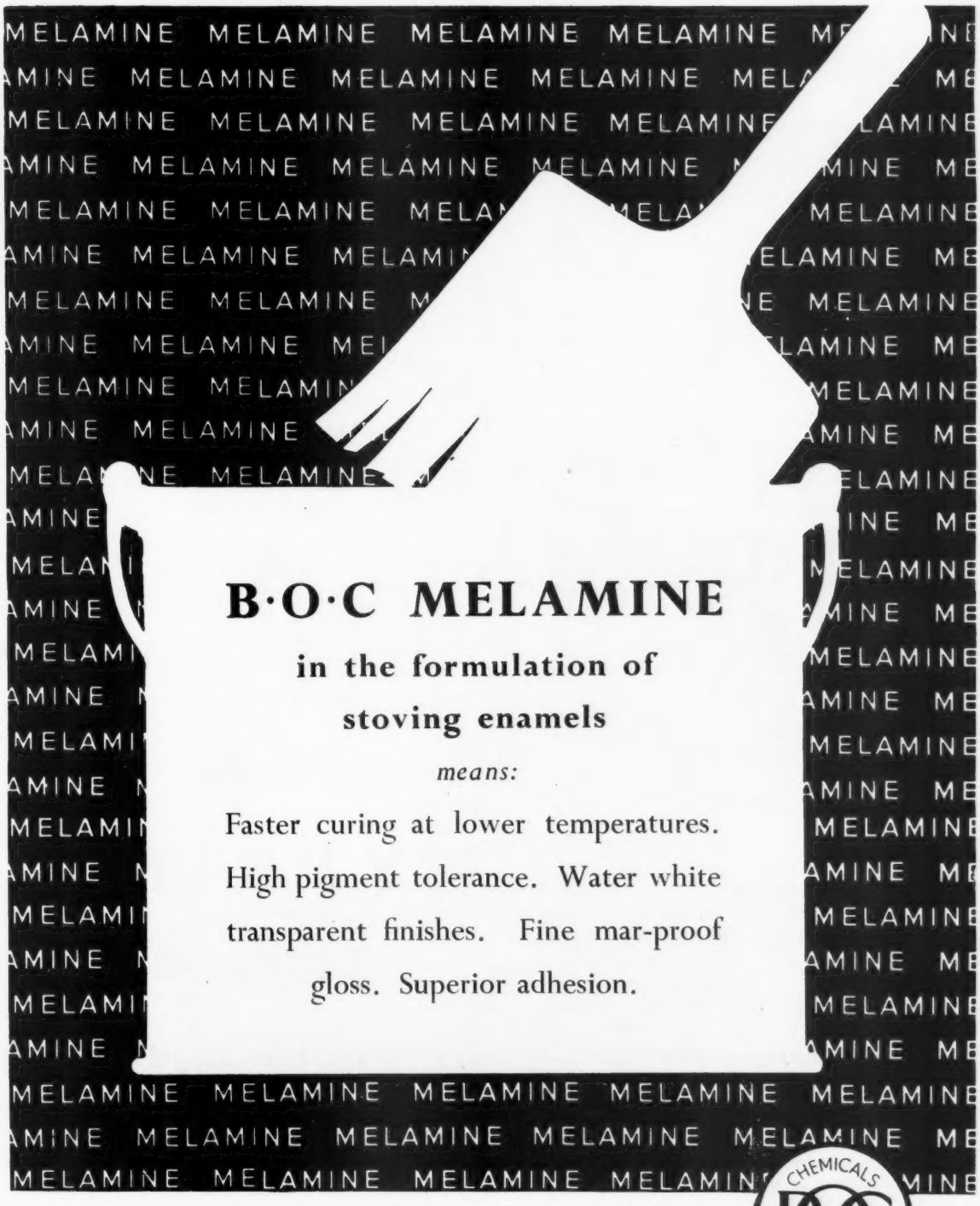
Tel. – Oswestry 790-1 OSWESTRY, SHROPSHIRE 'Grams: Insulation, Oswestry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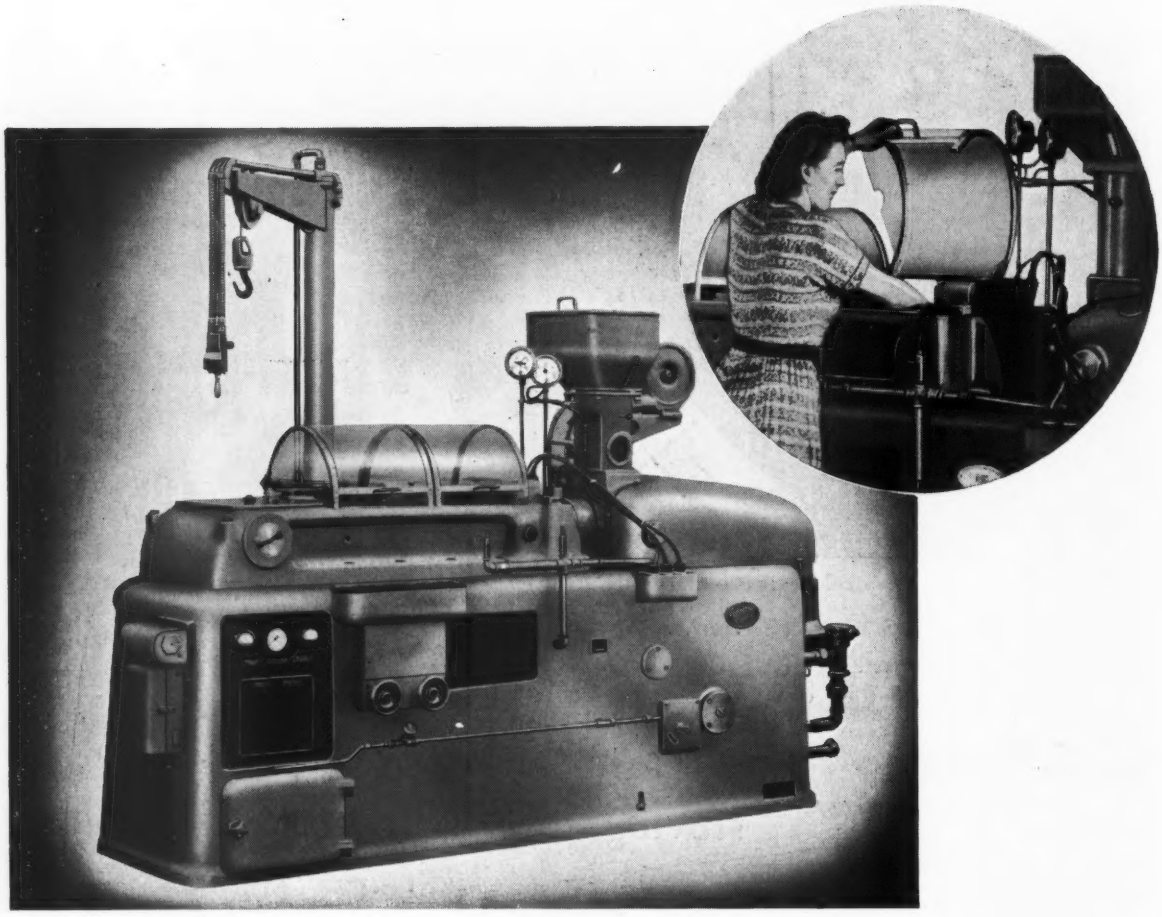

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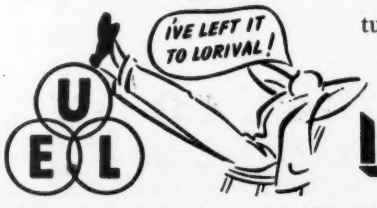

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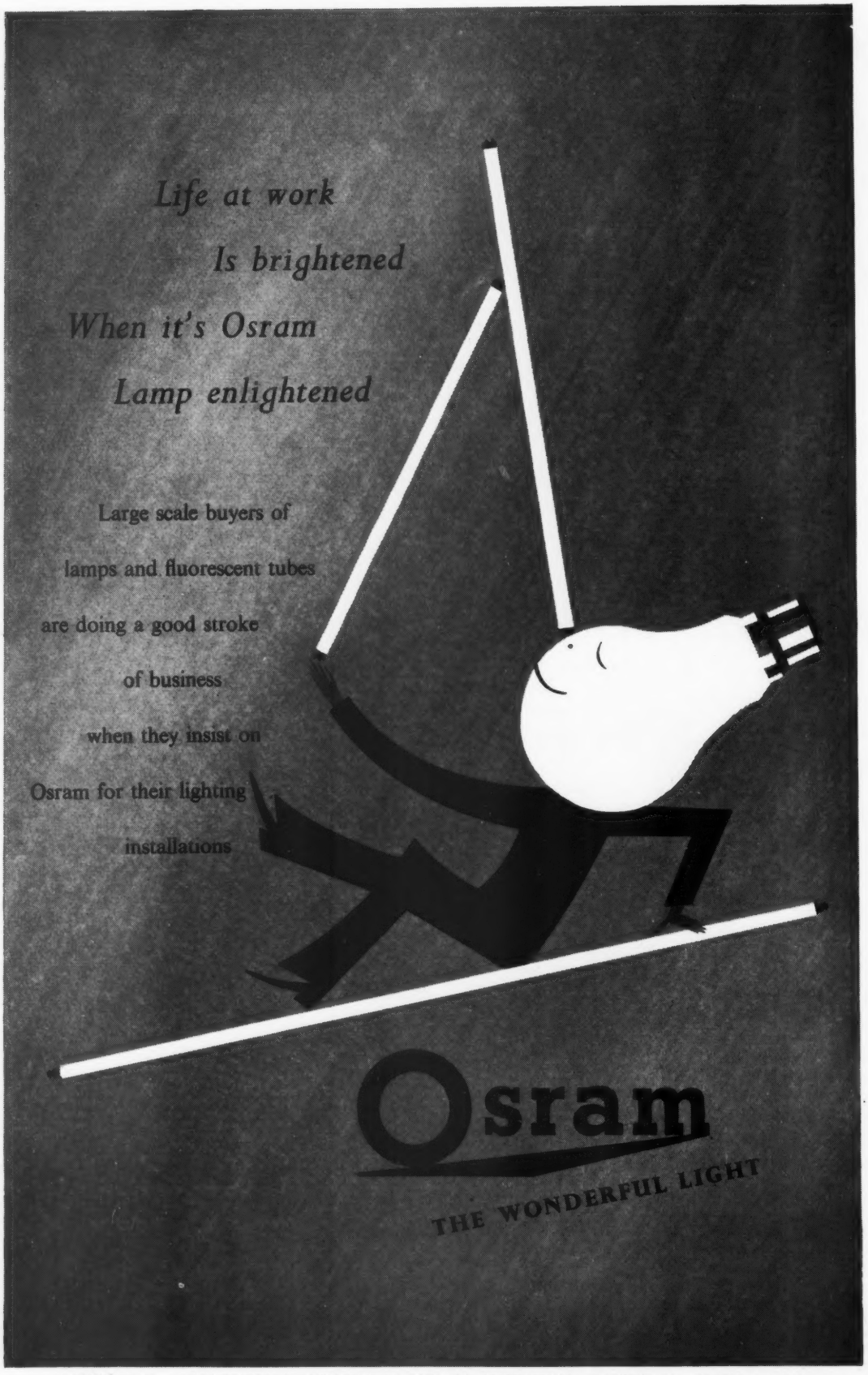

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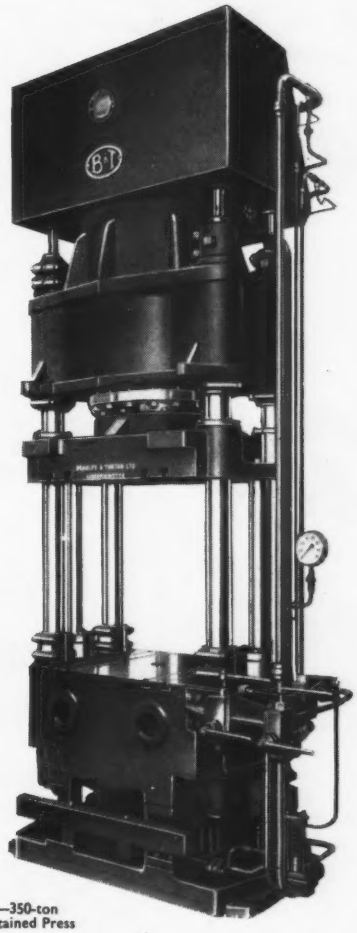

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A101

AVERAGE TESTS

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Saponification Value	385
Mean Molecular weight of Fatty Acid	145·7
Unsaponifiable	Trace
Iodine Value	0·8
Titre	13° C.

AVERAGE COMPOSITION

Caprylic	90%
Caproic	3%
Capric	7%

CAPRYLIC CAPRIC ACID

A101/2

AVERAGE TESTS

Acid Value	330/340
Saponification Value	330/340
Mean Molecular weight of Fatty Acid	160/165
Unsaponifiable	1% max.
Iodine Value	1 max.
Flow point	0/10° C.

AVERAGE COMPOSITION

Caproic	Trace
Caprylic	35-45%
Capric	30-35%
Lauric	20-25%

CAPRIC ACID

A102

AVERAGE TESTS

Acid Value	323·7
Saponification Value	323·7
Mean Molecular weight of Fatty Acid	173·3
Unsaponifiable	0·5%
Iodine Value	1·2
Titre	30° C.

AVERAGE COMPOSITION

Capric	90%
Lauric	7%
Caprylic	3%

LAURIC ACID

A103

AVERAGE TESTS

Acid Value	276 min.
Saponification Value	276
Mean Molecular weight of Fatty Acid	203
Unsaponifiable	0·5%
Iodine Value	1 max.
Titre	37·8° C.

AVERAGE COMPOSITION

Capric	Trace
Lauric	90%
Myristic	9%
Unsaturated Acids	1%

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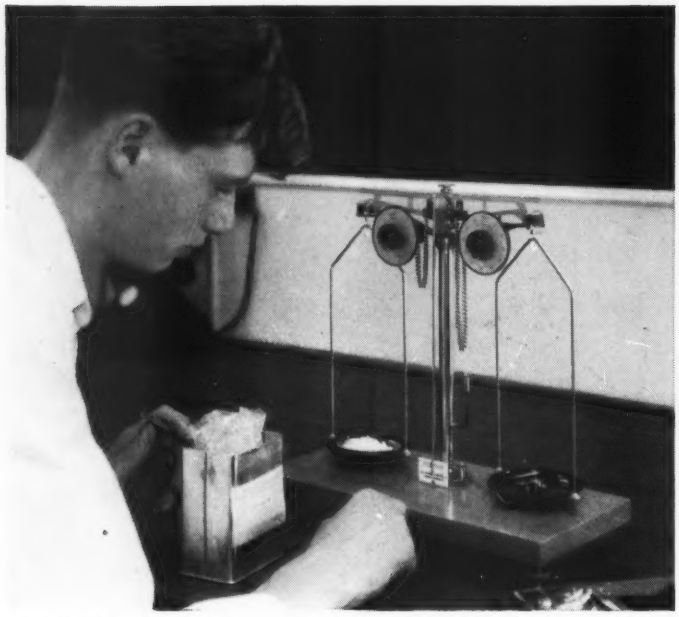


1 *Weighing dye for Colourant Blend mixing.*

2 *Filling drum tumbler with Colourant Blend.*

The LUSTREX* Dry Colouring

A simple, economical method of colouring polystyrene to any shade you want

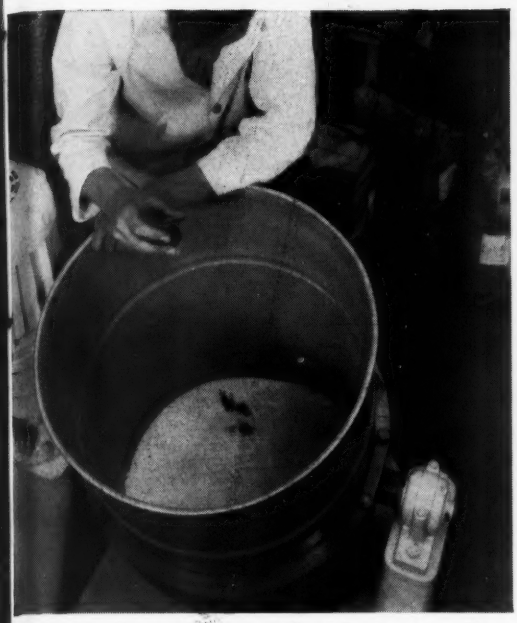
THE economic advantages of Monsanto's Lustrex Colourant Blend are being more and more widely appreciated in the industry since the advent of this versatile form of polystyrene.

The outstanding virtue of Lustrex Colourant Blend is the extreme simplicity with which it can be used in the dry colouring process. The only extra equipment required is a simple drum tumbler which will handle a charge of 50-150 lbs. of polystyrene and a balance on which the dyes can be weighed. Processing is easy. After mixing under controlled conditions, the dyestuff adheres uniformly to the surfaces of the Colourant Blend granules. The material can then be removed and fed directly into the injection moulding machine.

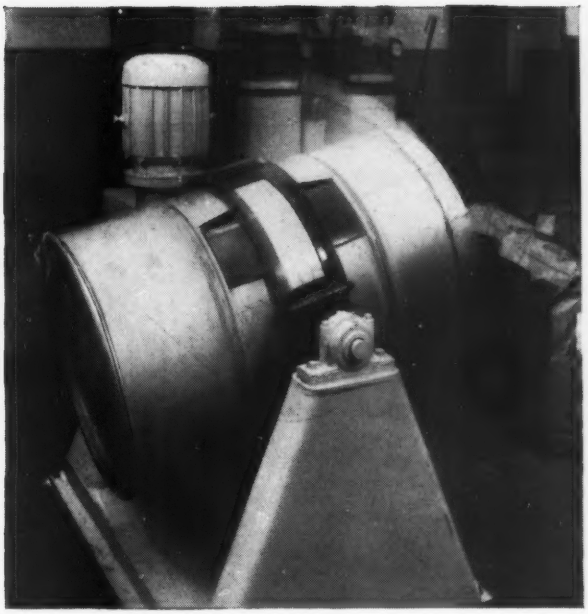
Our series of illustrations shows these operations, step by step.

But simplicity is not the only attraction of Lustrex Colourant Blend. Consider these points, too:—

Colouring costs are so low that savings of many pence per lb. can be made compared with coloured moulding powders. Colourant Blend is supplied at exactly the same price as Lustrex general moulding grade crystal. Any colour can be produced at short notice. This permits greater flexibility of operation.



3 *Adding dye to Colourant Blend in drum tumbler.*



4 *Drum tumbler in operation.*

Process

Only a comparatively small stock of crystal need be carried to produce all the shades desired. Leading moulders in the U.S.A. have found it possible to reduce stocks by as much as 75%.

Through the use of Lustrex Colourant Blend, it is now possible to produce — at reduced cost — a wide range of toys, novelties, houseware and miscellaneous articles which were previously moulded from processed colours.

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5 *Charging the injection moulding-machine hopper with Colourant Blend.*

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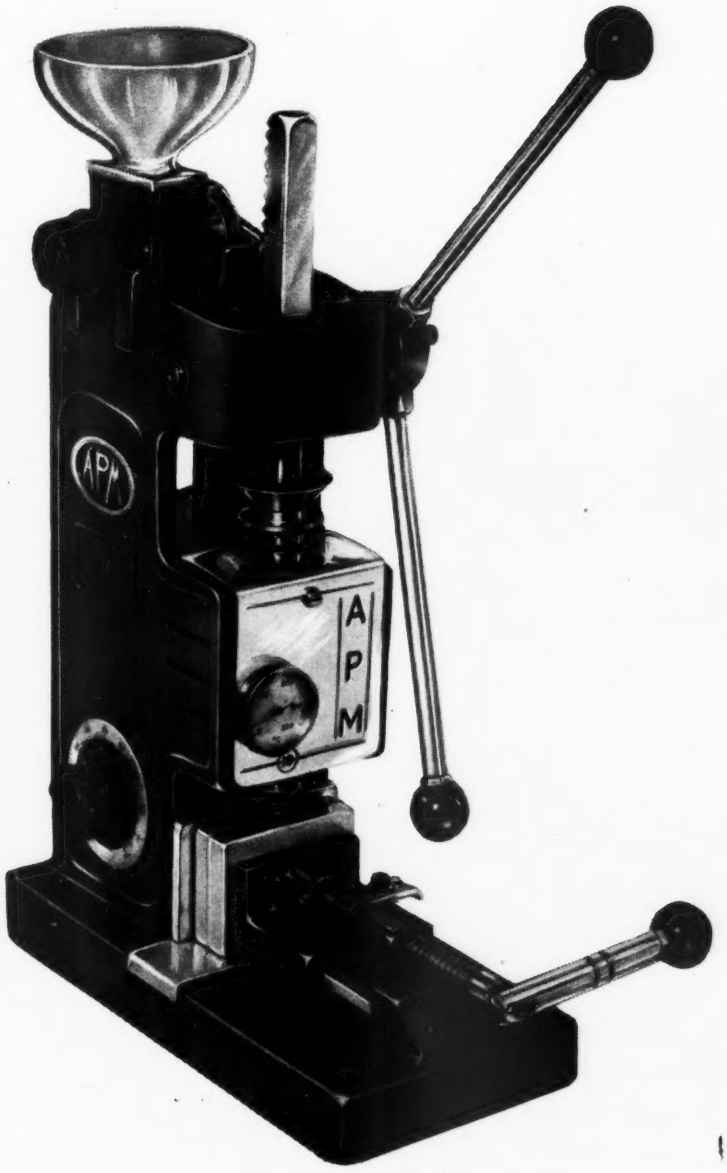
m and i

APM

HAND OPERATED BENCH INJECTION MOULDING MACHINE



★ **The A.P.M. machine is suitable for working all thermoplastics such as Cellulose Acetate, Polystyrene, Alkathene, etc.**

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★ **Maximum moulding capacity 2/3rds oz. (19 grms.) per injection.**

★ **Attainable production rate up to 100 injections per hour depending on mould design.**

★ **A Hopper giving semi-automatic feed control and a thermometer for heat control are incorporated in this Model.**

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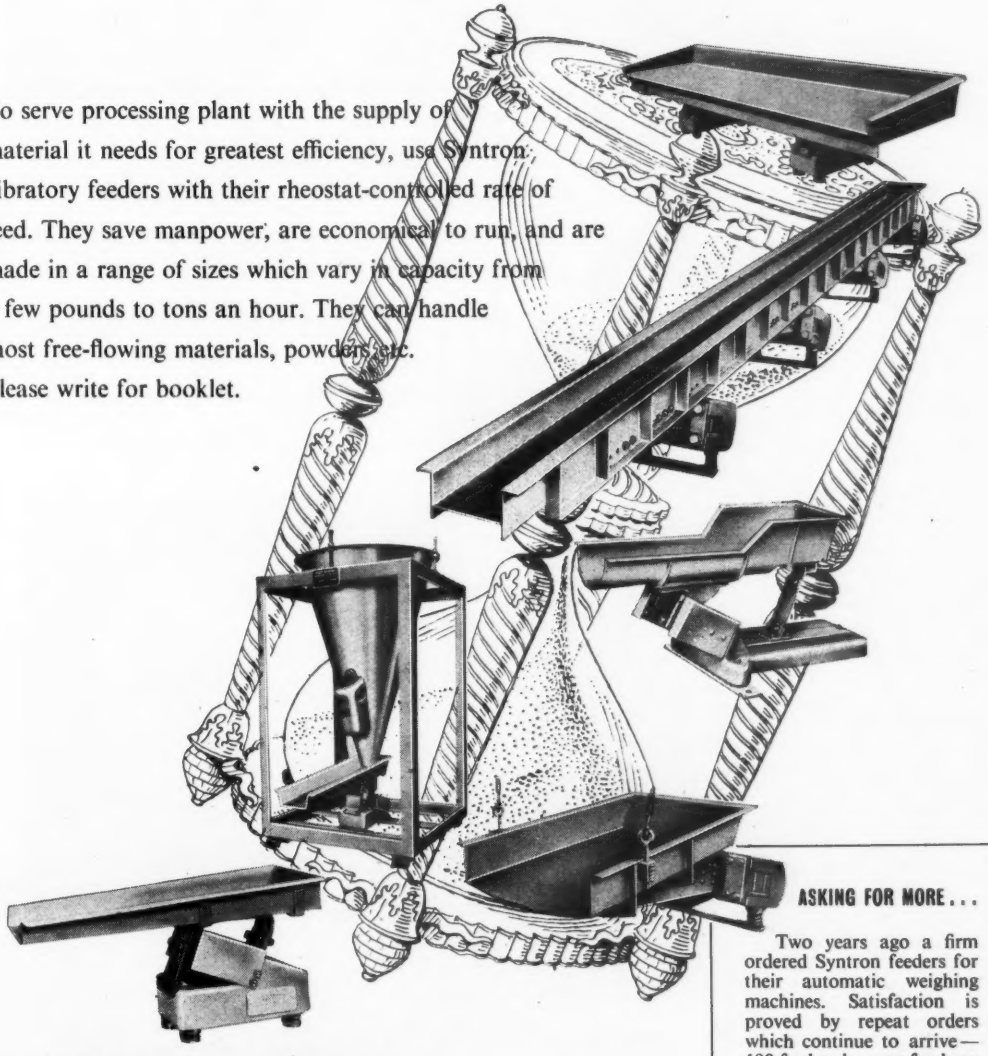

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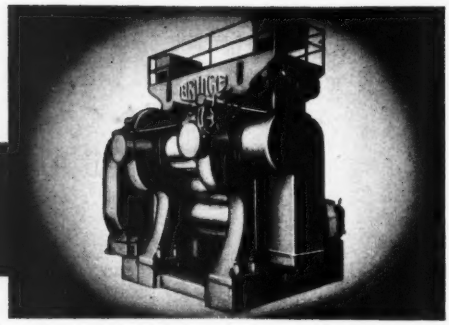

Precision Calender with three superimposed and one offset roller. Flood lubrication.

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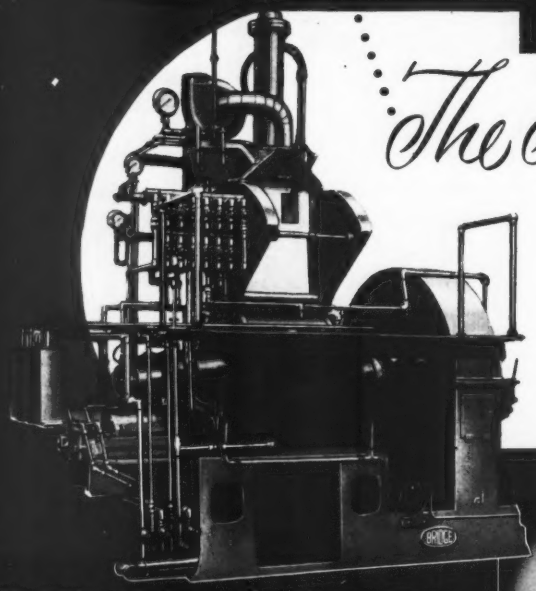
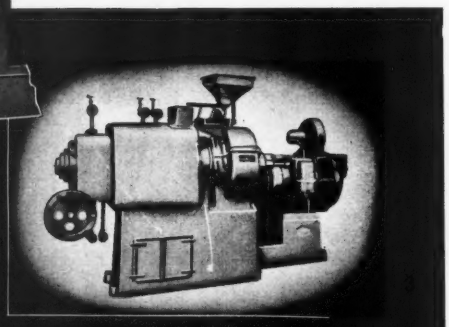
of DESIGN, SERVICE and PERFORMANCE *in* **RUBBER AND PLASTICS MACHINERY**



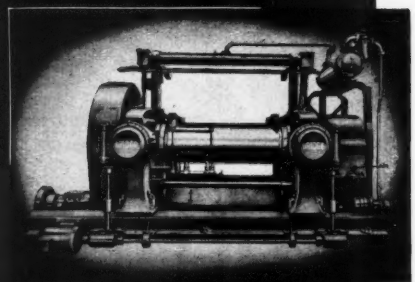
The Bridge — Banbury Patent Mixer. (1)

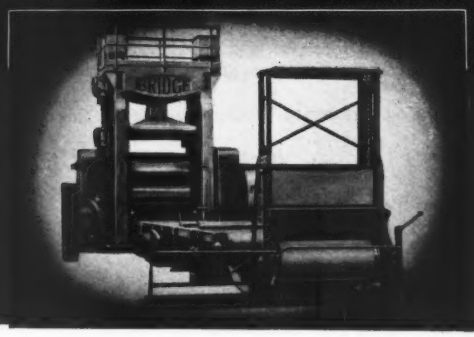
4½" Cold Feed Plastics Extruder. (3)



Precision Calender with four superimposed rollers. Flood lubrication. (2)

High temperature 22" x 60" Plastics Mill with flood lubrication. (4)





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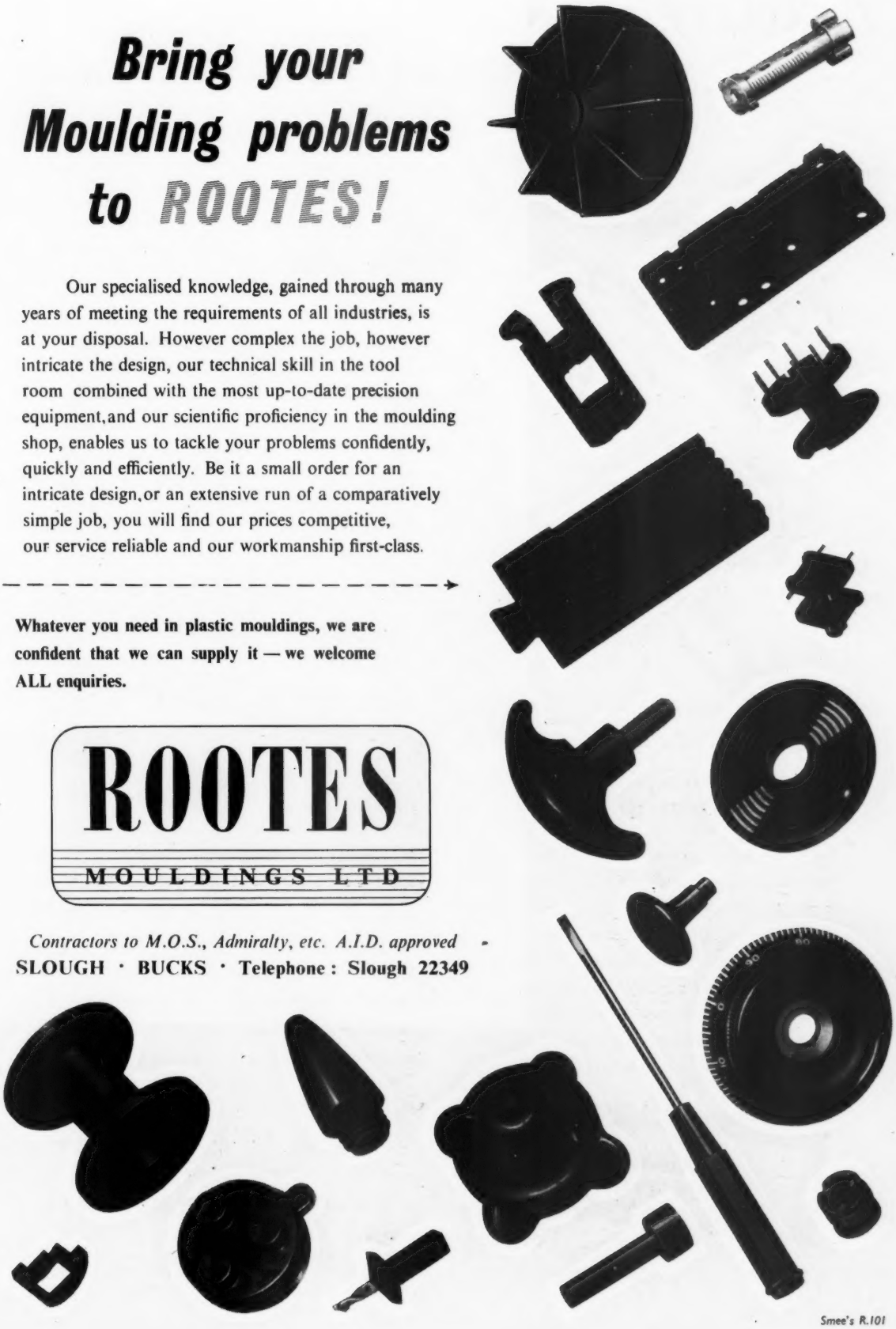

Smee's R.101

BAKELITE Materials
THE MEANS TO MANY ENDS

1 *Thermal control unit base*
2 *Electric kettle plug*
3 *Aircraft sparking plug elbow*
4 *Electric toaster*

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The heat-resistant group of BAKELITE Moulding Materials contains a mineral filler—fibrous or not, depending upon how much impact-resistance is needed. In many of these materials the cellulose filler is entirely replaced; X.5072 however, contains both mineral and cellulose, and is a very useful intermediate grade. These heat-resistant materials are available in black and—in certain cases—other colours and mottles

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of most grades
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Other properties available to the moulder in the wide range of BAKELITE Special Materials include low loss, low friction, and resistance to water and chemical action. For mouldings not required to work under particularly exacting conditions, the BAKELITE general-purpose Materials offer excellent mechanical strength, together with the highest degree of uniformity and accuracy. *Almost all can be delivered in 24 hours.*

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MOULDING MATERIALS
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P47

Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

PROPRIETORS: TEMPLE PRESS LIMITED

CHAIRMAN and MANAGING DIRECTOR: ROLAND E. DANGERFIELD

CONTENTS

	Page
Editorials	281
Moulding Powder and Shot	282
Growth of a Factory	283
Dimensional Stability of Amino-resin Mouldings, by E. E. Halls	287
Transatlantic Cable	289
Plastics in the Service of Man	290
Plastics at the Farnborough Show	294
High Frequency Heating, by S. R. Hawkins	295
World's Industry Employs Plastics	299
New Productions	301
Letters to the Editor	300
Production News	302
Stress Gremlins in Thermosetting Plastics, by H. M. Quackenbos Jr.	305
Machines for the Industry: Plasticor ¾-oz. Injection Moulding Machine	307
Patent Review	309

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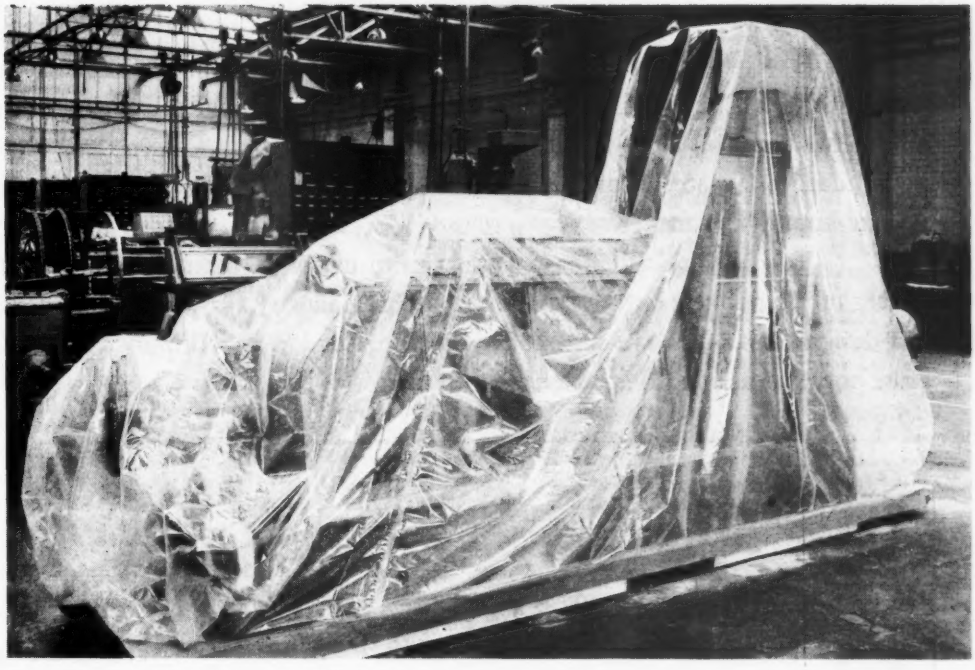
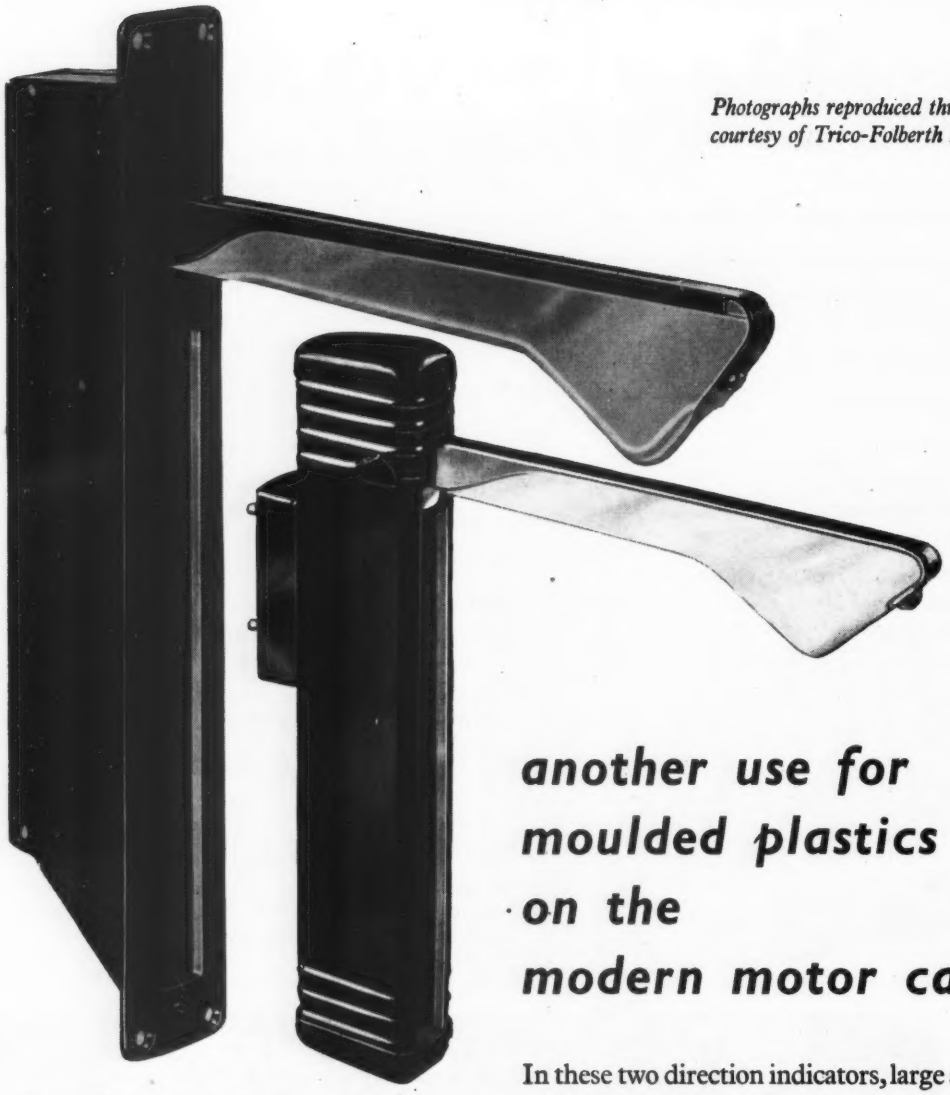


High-precision cable-making machinery being shipped by Standard Telephones and Cables Ltd. to an associated company in Italy, is completely wrapped in "Alkathene," I.C.I.'s polythene film. A sheet of film more than 400 sq. ft. in area—made from standard width material by heat-sealed lap joints—provides complete protection for each component. Washers made from polythene sheet prevent moisture entering through the bolt-holes in the base board.



Photographs reproduced through the courtesy of Trico-Folberth Ltd.

another use for moulded plastics on the modern motor car

In these two direction indicators, large and small, made by Trico-Folberth Ltd. the familiar orange coloured arm is moulded from translucent plastic material in our two factories at Birmingham and London. Strength, dimensional accuracy and adequate light transmission are all of the utmost importance in the Trico signalling device and moulded plastics supply the answer.

The National Plastics operating companies have been developing and producing a large variety of plastic components for the automobile industry for more than fifteen years. Engineers and designers of our Development Division, in London and Birmingham, are always available to assist potential users of these versatile materials.

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TWO NATIONAL PLASTICS COMPANIES BM172

Plastics

VOL. XVII. No. 183 OCTOBER, 1952

EDITORIALS

Table Covers

LAST month we expressed ourselves rather emphatically on the type of table cover we thought would approach the ideal for the housewife. We plumped for a fabric-based p.v.c., the opaque surface of which consisted of a "texturized" background over-printed with a damask design. It was a heavy sheet (30/1,000-in. thick) and obviously was not manufactured for use as a table cover, but its great strength, excellent washability and beauty impressed us with the certainty that somewhere in this field of production lay the answer to one of the housewife's problems. That it was rather too stiff in draping qualities is obvious from the thickness—a subsequent testing of a kitchen table cover 15/1,000-in. thick, similarly manufactured by the same maker, draped excellently and also possessed the other desirable properties of washability, strength and resistance to staining. The thickness is that of the p.v.c. plus fabric.

At the same time we referred to the thin transparent table cover (generally printed with a white lace-like or similar design and of 4/1,000-in. thickness) as a mere protection to a linen or cotton one and that its thinness resulted in rumpling of the surface. We inferred, in fact, that it was an unnecessary addition since the opaque plastic table cover serves the dual function of providing beauty and supreme utility in the one sheet.

In presuming, however, that the fabric-backed type was the only form of p.v.c. sheeting that should be sold, we showed an ingenuous ignorance of the variety of demands that actually exist, and, of no less importance, of what housewives can afford to buy. For further guidance on the subject we visited the works of Storeys of Lancaster, a company whose history of table-cover manufacture goes back to 1846, whose present production of p.v.c. sheeting in a variety of forms is superb and whose standard of control of quality is a measure of the fame of their products in this country and abroad.

The years of experience have taught them, we learned, that in this field as in most others, there are, beyond any doubt, several distinct classes of the buying public that express their wishes quite clearly.

There is on the one hand that section who because of conservatism or sentiment (rooted perhaps in the table oilcloth) prefer the cloth-backed type (the fleecy cotton form) and this, evolved at Lancaster more than four years ago, remains in all markets of the world, the first choice.

There is a second section, equally distinct and wider spread, that has shown a very marked preference for their all-plastic table cover of equally heavy duty performance. The standard average thickness of the p.v.c. is of the order of 9/1,000-in. (the B.S.I. standard for heavy duty table covering being 8/1,000-in.). In both the foregoing cases retailers, wholesalers and their customers have learned that the covers are quite unaffected by the heat of cooking dishes and pans except of such heat as results from immediate removal from a fire (obviously no housewife would perform such an action without first using a cork or similar mat). Users of this all-plastic type also point out, quite apart from the comparative price, that while the cloth-backed form possesses greater (perhaps for the conditions, excessive) strength, it also acts as a harbourage for dirt and germs and prevents the cover from being wiped, both back and front. The unbacked sheet can be so treated or totally washed in hot soapy water, rinsed and dried by mere wiping. Non-slip characteristics are provided for by "texturizing," which also gives a cloth-like feel to the sheet. All agree that it is, under normal hard treatment, almost impossible to tear the heavy duty all-plastic type unless such is the deliberate intention. This is another way of stating that the compilers of the British Standard Specification were correct in making the standard thickness 8/1,000 in.

There are also in range of manufactures of Storeys of Lancaster two other all-plastic table covers evolved for quite different sections of the world's buying public. In one case it was reasoned that since the heavy duty all-plastic form described above was so strong and possessed such a long life—indeed it exhibits a surplus of performance—that a lighter duty type of correspondingly lower price would be welcomed by those to whom price was perhaps all important. This manufacture has opened up a new section of the public without detriment to the already existing markets. This type of cover is of 5/1,000-in. thickness, is "texturized" on the back similarly to the heavy duty sheet and, like it, the design is imprinted in various colours on a white opaque ground. A second light duty form is also all-plastic 5/1,000-in. thick, with a "texturized" back, but has a transluscent ground and so is distinct in appearance and purpose from other productions. It was evolved to satisfy the demands of those who use the transluscent form, which also has pleasant printed designs, to protect a plain white linen or cotton table cloth or to add gaiety to their rooms. This too has opened up a new field and usage, again without detriment to the demands of those types already described.

—And Specifications

THE foregoing notes clarify the whole subject satisfactorily and we are greatly indebted to Storeys for their collaboration. The manufacture of plastic table covers in general has on the whole delighted the housewife by a careful study of her needs translating them into quality demands in the factory. There have thus been compiled in this country as elsewhere a number of specifications relative to minimum thickness, strength, colour fastness, and so on, which must be complied with if high quality means anything and if we are to retain our markets. We do not want to see a return, even in the smallest degree, to what happened in the immediate post-war years when certain irresponsible manufacturers foisted on an unsuspecting public very inferior and almost useless goods. The reaction of those who purchased such goods was rapid and a decline in buying followed. The past three or four years have luckily seen the emergence of high-quality material and we have profited by it.

We stress these points because it is whispered that table covers of less than 3/1,000-in. are being made and sold. This may be the result of strong competition and the desire to diminish prices; it also is the road to failure.

Charles Butcher

THE Editor regrets to announce the death of his old friend and colleague Charles H. Butcher after a short illness. He had joined the staff of this journal in 1946 but the friendship dates back to the beginnings of another technical journal in 1925, the "Industrial Chemist." "Butch," as he inevitably became known to his intimates, was then a valued contributor to that journal on the subject of microscopical examination of chemical raw materials and on chemical engineering.

As a youth he had worked to enter the medical profession and while he could not continue owing to financial stringency, his work in the hospitals stood him in good stead in his later life. He was an expert microscopist and this with his basic knowledge of chemistry became the background for his journalistic life—he joined in 1928 the staff of "Chemical Age," a weekly paper, and later of an architectural journal.

His interests were exceptionally wide and at times it was difficult for the outsider to guess which was his life's work and which his hobbies. He came of a very old Essex family whence grew his love and collection of books, his intimate knowledge of East Anglian history and church architecture and of such apparently strange subjects as English manorial rights, ancient illuminated manuscripts, English place names, regimental dress and commissions and their American affiliations, and numismatics. Above all he was most fortunate in his marriage; his wife made him happy and shared his thoughts and his love of books and of history. All the workers at Temple Press offer her their sympathy.

As for his work as a journalist his knowledge was as profound as his methods were painstaking. We lose a colleague who was quite irreplaceable in his own line of country.

MOULDING POWDER AND SHOT

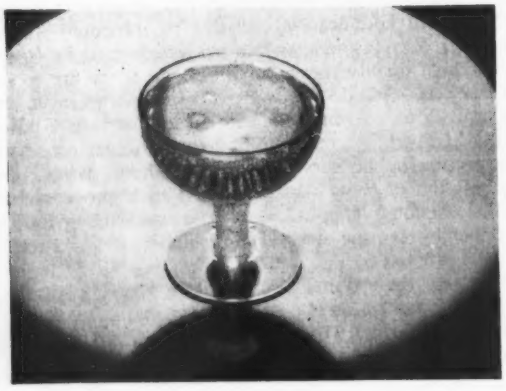
Plastic Water-Pipes

I have just received information that a pipe research project has been undertaken by the Society of the Plastics Industry Inc., of the U.S.A., to determine the performance characteristics of plastic pipe in the transmission of water in rural supply systems. This project, which was started at the suggestion of several S.P.I. members who are plastic pipe extruders, was originally prompted by the reluctance of certain State Public Health authorities to approve such installations in the absence of an authoritative statement of the advantages of such piping and its toxicological characteristics. The work is being undertaken by the National Sanitation Foundation, which is affiliated with the School of Public Health of the University of Michigan. The materials under test are polythene, polystyrene, cellulose acetate butyrate and copolymers of polyvinyl chloride. Quarterly progress reports will be issue. We in this country appear to be slightly ahead of the U.S.A. The British Plastics Federation state that a British Standards Institution Committee is at present studying a draft standard prepared by the Federation for polythene pipes for water services. Another standard under consideration deals with polythene pipes for general purposes, including the food industry. Further preliminary work is in hand for standards on p.v.c. pipes. Informal collaboration with water authorities is being maintained by the Federation.

* * *

Bubble, Bubble!

British European Airways have sent me a nice example of one of the amenities of modern civilization with which they supply the travellers in their aircraft to make life even more pleasant than it normally is. My photograph shows a champagne "glass" made by B. Attewell and Sons, Ltd., from "Perspex" sheet by the blowing technique and as our readers will admit, it is no mean job, especially as the stem has been made hollow in the traditional manner so that the twinkling, sparkling bubbles may be seen mounting from the foot to the rim. It is good to see this as many British glass makers have, in recent years, omitted the hollow stem. I wonder, however, when it was that the modern broad champagne bowl was first introduced. I have some old champagne glasses with hollow stems, but they are of quite normal wine glass shape (2¼-in. diameter).



* * *

Craft versus machine

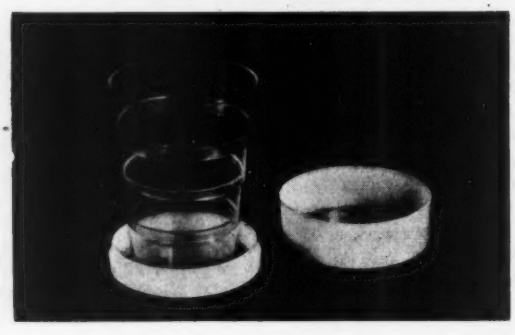
When I visited the S.B.A.C. at Farnborough last month I was intrigued by one of the exhibits at the R.A.E. stand: it showed the production of wind-tunnel models using undersize metal blanks which are built up into accurate profiles by using epoxide resins (see p. 294). This is one of the very rare cases in which, paradoxically enough, the craftsman is employed to save on the time normally spent in machining a solid oversize piece of metal. Indeed, the time saved can be as high as two-thirds.

* * *

Ancient History

Some weeks ago the collapsible cup seen below and moulded from polystyrene was shown to me as a completely new idea, at which most readers will smile. On the other hand they may merely agree with me that even old ideas are new to many people, which is a very good thing. However, at least we can say that there has been improvement in the production. I first saw it about 1936 as 2 rings and base moulded from "urea" and sold loose. The next improvement was their enclosure, still as loose rings, in a little box, and by then was also made of cellulose acetate. The example seen below has the smallest ring cemented to the base of the box, also of polystyrene so that no ring can become separated and lost. As for the age of the idea, it was certainly made from aluminium many years ago and I have been assured by somebody that he had seen one made of ivory rings. I expect any moment now to be told that there's one in the British Museum.

DOGSBODDY.



Growth of a Factory

THE amazing flexibility of the plastics industry, so far as the variety of products made by it is concerned, has always been a source of wonder to the world, a wonder that is a reflection, not only of the different types of plastics available (each possessing different properties from the others and thus satisfying different demands by the public and by industry), but is also a reflection of the variety of processes and equipment which transform the different raw materials into shape. It is still more remarkable, in an industrial world that has been built up, taken by and large, on the basis of "one factory, one raw material, one process," to find in the plastics industry the existence of a number of works that employ not only many types of plastics but also a great variety of processes each entirely different from the other.

This was far from being the case 25 years ago, when segregation of type of manufacture which also meant type of raw material, was the rule. The thermoplastic materials and the machines to mould them had not emerged from the chrysalis stage and the earlier sheet, rod and tube fabrication from celluloid and casein was not regarded as the sphere of the thermosetting resin moulders, although curiously enough a number of the latter had begun "life" as moulders of the thermoplastic materials of the bitumen/asbestos/silica and shellac types.

To-day the picture is very different and while there remain factories that are restricted to sheet manipulation only, to injection moulding only, to extrusion only, and so on, it is also true that it is difficult to point to a compression moulding plant that does not contain a number of injection machines. Some factories based on injection moulding have introduced extensive extrusion plant, while others following demands during the war period, studied and practised the post-forming of laminates and have pursued this work to-day into still newer forms.

It is much rarer, however, to encounter expansion "outwards" in a factory that was originally devoted solely to forming from sheet; and as remarkable as any among the few that accomplished this successfully and broadly is Thermo-Plastics, Ltd., of Dunstable, whose factory we previously described in 1940 and 1949. This company had originally confined itself almost entirely to the production of aircraft components from cellulose acetate sheet and then from "Perspex" utilizing well-known plant for this type of work: heating ovens, formers, presses, blowing and vacuum processes and annealing ovens.

Since the end of the war, expansion has been wide and rapid and, moreover, has followed a deliberate scheme to cover a number of developments, some of them "new," all growing rapidly. These included refrigeration, the catering trades, television, lighting and heavier industrial work. Obviously the scheme also provided for the growth of the aircraft industry, including the increasing urgent demands by peace-time air transportation. Indeed, this section of the work is still the largest in the factory and is also remarkable for the new techniques and new materials that have been developed since the war.

To cover all these demands, the compression moulding shop, begun in 1945, has now been completed together with its ancillary tool and mould making side, an injection moulding shop has been created since 1946 and finally new buildings for the production of glass-fibre/resin laminates have been erected. The additions since 1949 may be summarized as follows:—

Fabrication from "Perspex" sheet. The new plant includes:—

a. Installation of new ovens and ancillary equipment to heat exceptionally large sheets of increased thickness (aircraft hoods are now ¾ inch thick and the thickness is expected to increase with the appearance of new aircraft).

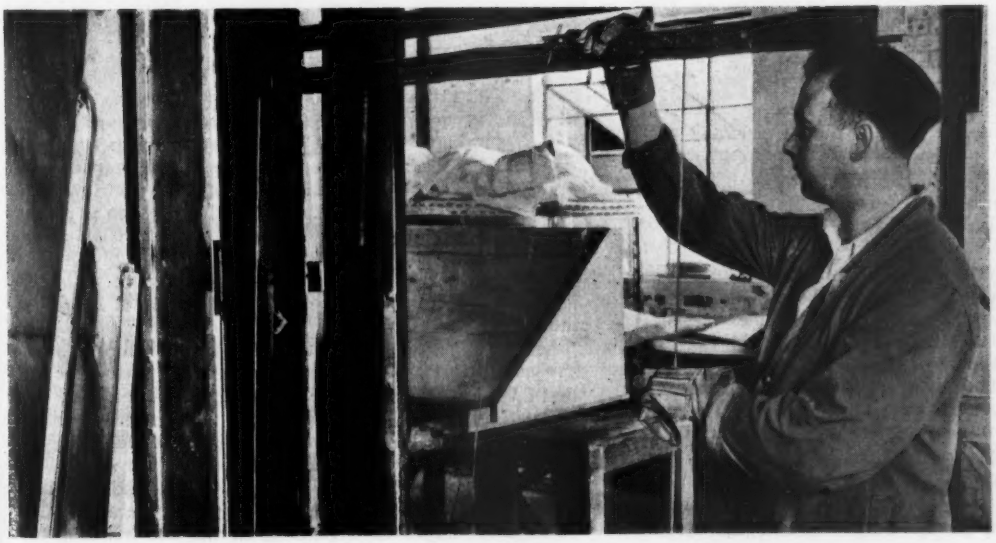


Fig. 1.—The new large vertical heating chamber for heating very large sheets of "Perspex" prior to forming into aircraft cockpit covers.

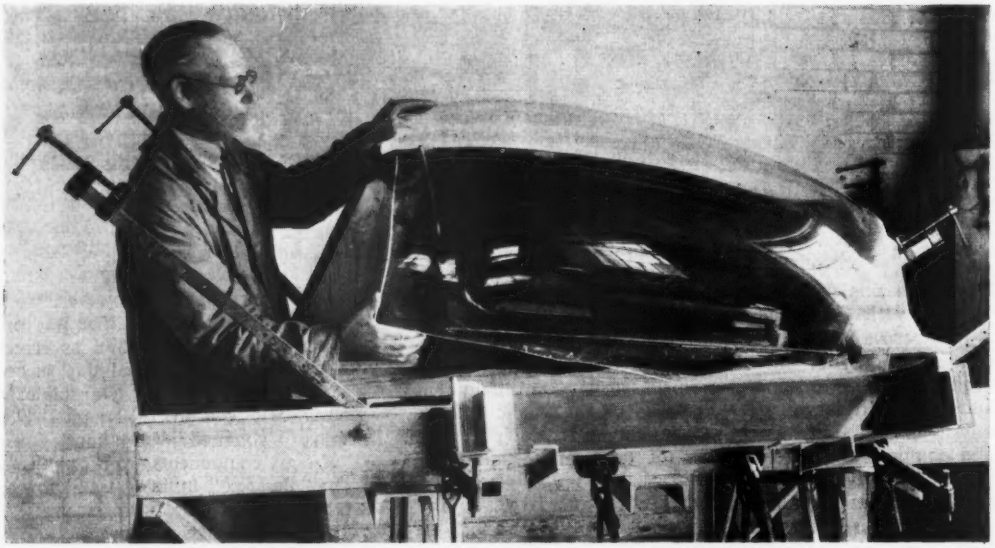


Fig. 2—The heated plastic sheet is then formed on a wooden former using special brackets to keep it in position until cool.

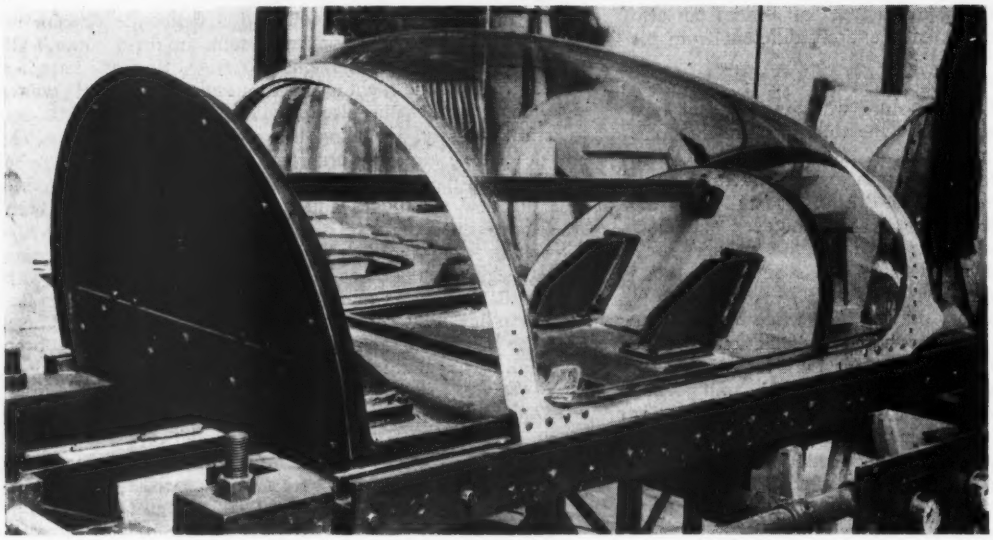


Fig. 3.—The formed "Perspex" is trimmed and set up in position in a cockpit "mock-up" for testing clarity, stresses, etc.

b. New "Perspex" cementing ovens containing U.V. lamps for polymerizing cement.

c. Plant for the new process of jointing "Perspex" to aluminium by an intermediate thickness of rubber. This is of special importance for pressurized aircraft.

Compression Moulding Shop. The output generally comprises components of the electrical and engineering type.

Injection Moulding Shop. The main output consists of components for refrigeration, of mouldable units for the aircraft industry and also of components which are parts of advertising displays.

Thus, while, as we have already pointed out, manufacture proceeds on carefully conceived lines to cover a number of specified industries, this often means considerable collaboration between the different shops. Hence one finished unit may conceivably be made up of three different components—one that is shaped from sheet, another compression moulded from thermosetting resin and yet a third injection moulded from acetate or polystyrene or polythene.

Glass Fibre/Resin Shops. This section, first developed in 1948, now includes a continuous glass-fibre coating unit, metal mould making section including aluminium guillotining beating and welding plant, plaster mould making and drying ovens (using infra-red lamps), impregnated fabric cutting and "tailoring" sections and stove-curing and testing plant.

Production Details

Production of aircraft components is the largest section in the factory, the output including hoods and radomes of "Perspex," and scanners, radomes, hot air ducts and other structures of glass fibre/resin laminates. The radomes may also be built with intermediary modifying layers of synthetic rubber or expanded plastics. Electrical units such as aircraft terminal blocks are of phenolic moulding materials. Special productions include a silica-gel loaded tube suitably threaded for keeping stored aircraft cylinders moisture free. The tube is threaded into the sparking plug entry point. It is injection moulded from "Diakon."

Second largest of the productions is in the field of television screens. As an example of the size of this section, we note that 2,000 masks a week are made for one firm alone.

Catering is third on the list and has grown rapidly in recent years not only because of the impetus induced by the Ministry of Education in providing meals for schools and the obvious advantages of plates, cups, saucers and trays made from plastics for works canteens, but also because of the demand for improved hygiene in storing and handling food

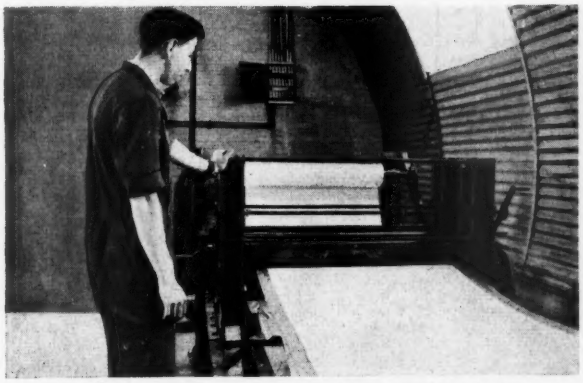


Fig. 4.—Machine for continuous coating of glass fabric with polyester resin.

Fig. 5.—"Tailoring" and hand-impregnation of glass-fibre with resin for "radome" production.

Fig. 6.—Lining of Dural mould with heated glass-fibre sheet—

Fig. 7.—is followed by the insertion of a rubber bag in the mould, which is closed. Pressure is applied and the mould cured in an oven at 140° C.

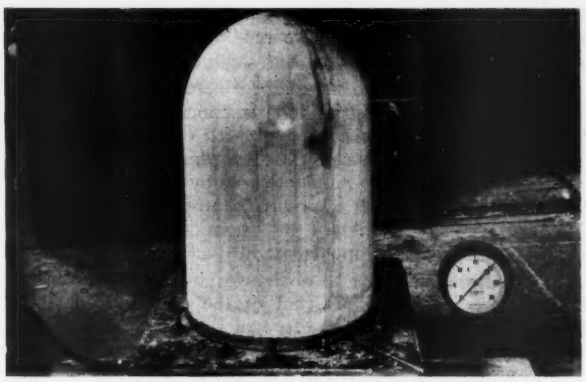


Fig. 8.—On removal from the mould, each radome is tested for possible air leakage.

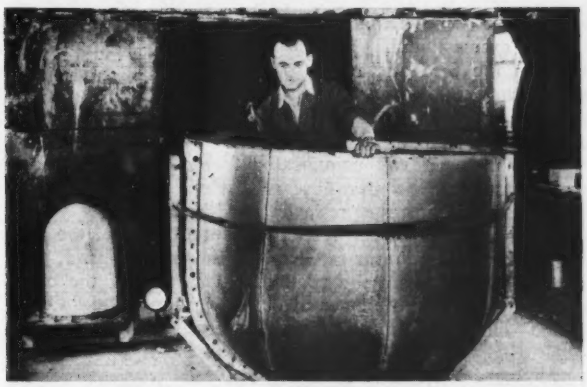


Fig. 9.—The above shows the lining of a large mould with a glass fabric/Hycar/glass fabric sandwich for the production of a special radome.

in shops, tea-rooms, restaurants and hotels. Deep and shallow trays of plastics have been welcomed especially by butchers—the easily cleaned non-toxic "Perspex" and "Cobex" fulfilling a long-felt want. Catering in aircraft has assumed great importance and the air transport companies are fully alive to the necessity of lightness in their feeding equipment. Latterly Thermo-Plastics, Ltd., have specially designed a coffee cup and saucer for B.O.A.C., the base of the cup fitting snugly and securely in a circular ring rather deeper than normal in the saucer.

The high production of components for refrigerators two years ago made this section third in output, but the incidence of purchase tax and other reasons have reduced its position to fourth. Among the components made are evaporator doors injection-moulded from polystyrene on a 16-oz. "Peco" machine and ice-cube "moulds" from polythene using a smaller machine.

Production for advertising, the next largest manufacture, is most generally of the type made from sheet and can vary in size from the huge illuminated "Shell" display, for use outside garages, to small counter and bar announcements. On the other hand, as customers realize the versatility of plastics the displays may become more complicated. Thus, one Biro advertisement employs sheet, a moulded phenolic base and an injection-moulded polystyrene ball.

The new section devoted to lighting is growing steadily, the main production at present being very large and smaller strip-lighting hoods and diffuser louvres of the cell-type,

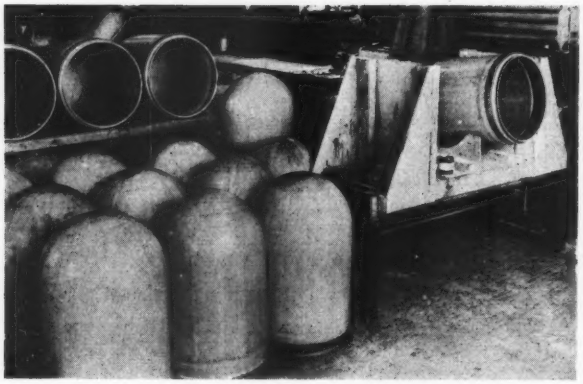


Fig. 10.—A number of glass-fibre radomes ready for dispatch following tests under pressure.

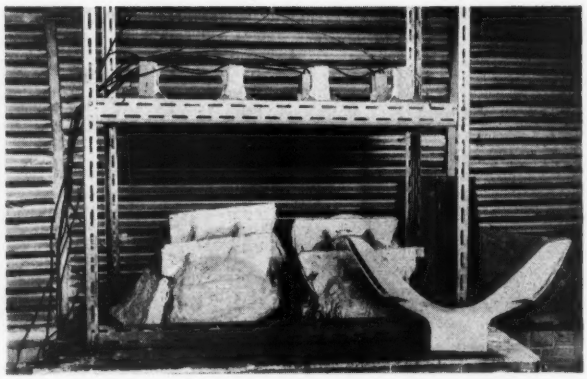


Fig. 11.—Infra-red drying of plaster moulds used for complicated structures of glass-fibre laminates.

which, for obvious reasons, have replaced the original aluminium forms. They are now constructed from slats of 0.030-in. "Cobex" sheet, slit at intervals from top and bottom and can be exported in that form to be assembled on arrival. Cells vary in size, the 2-in. square being normal.

Glass Fibre/Resin Structures

Since these new materials and processes are much in the technologist's eye, it may be interesting to describe in some detail the methods employed at Dunstable.

The raw materials are glass-fibre fabric and the two polyester resins "Nuron" and "Marco," manufactured in this country by I.C.I. Plastics Division and Scott, Bader and Co. respectively. The newest machine installed here is a continuous coating machine (Fig. 4) for the production of fire-proof lining for aircraft.

The glass fabric, 3 ft. wide, is fed from a roller into a dipping tank containing the liquid resin and then between rolls made of synethetic rubber resistant to solvent to remove excess liquid. Tension is maintained on the fabric between the feed and roller to prevent rucking. The wet fabric then passes on to a tunnel heated with infra-red emitters, the resin-impregnated fabric being thus cured after a run of 25 ft.

When moulded and complicated forms of laminates are to be produced, the glass-fibre is first cut and then soaked with the liquid polyester resin by hand-brushing.

As an example, we can refer to the production of the new types of glass-fibre/resin radomes, as shown in Figs. 5, 6, 7 and 8. Here we see the coating and cutting of the cloth and its fitting on to the inner side of a Dural mould. "Cellophane" film is laid on to the fabric to serve as a parting-agent, and a rubber pressure bag is placed within. A gasket and closure is then fitted and closed, and the whole, under pressure, is placed in a heated oven, the temperature being of the order of 140 degrees C., the time of cure varying with the accelerator content of the resin. On removal from the oven and mould, the radome is tested under pressure to discover possible air leakage.

The structure and the thickness of the radome may vary considerably. Furthermore, "Hycar" synthetic rubber may be employed bonded as an intermediary layer between two glass-fibre resin skins. Alternatively, a "Dufaylite" glass fibre/resin honeycomb structure may be used as the intermediary layer.

More complicated forms made with these materials by the same technique include hot-air ducts for aircraft. The moulds for such shapes are of plaster, shaped by hand and dried with infra-red lamps (see Fig. 11). As with radomes, the moulds are carefully covered with "tailored" strips of impregnated glass fabric and "cured" in ovens. The plaster moulds are then broken away from the interior.

Yet another important development here in the broad field of aircraft and industrial construction is the use of "Durestos, the phenolic/asbestos felt manufactured by Turner Brothers (Asbestos), Ltd., to which we have often referred in these pages. As pointed out by several authorities, "Durestos" possesses its own specific properties and advantages and is being employed by Thermo-Plastics, Ltd., for certain complicated components and ductings.

In conclusion, we beg to acknowledge the help given by the directors and technical staff of the company for their help in the construction of the foregoing notes.

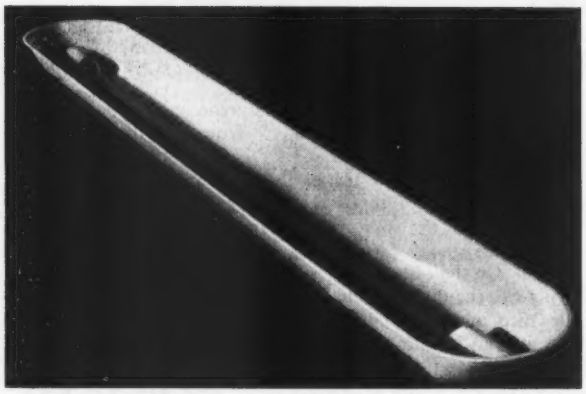


Fig. 12.—Fluorescent lighting reflector (3 ft. long) made in white opaque Perspex.

Fig. 13.—The most recent designs of cups and saucers that have been issued by these works.

Dimensional Stability of Amino-resin Mouldings

By E. E. HALLS

ALTHOUGH the phenolic resin thermosetting materials probably provide for the major proportion of moulded components, the amino-resin thermosetting class serve an exceedingly wide range of interests and, in bulk, no mean quantity of articles.

Apart from their general-purpose attributes of dimensional stability, inertness towards chemicals and solvents generally, mechanical strength, and the specific qualities of special grades, such as electrical strength, water resistance and shock-proof qualities, the phenolics are comparatively easy to manipulate by moulding processes and are relatively inexpensive. Their chief shortcoming appertains to colour, pale pastel shades being impossible. It is in this last direction that the amino-resins excel, and they do this while maintaining in fair measure many of the primary advantages of the phenolics.

The amino-resin moulding materials to-day embrace several types, the outstanding of which are the urea, modified urea with low after-shrinkage properties, and melamines.

All of these resins are exceptionally pale in colour and are thus able to provide pastel shades in moulded components. This has earned for them many important applications that could not be fulfilled economically, and, in some cases, could not be satisfied at all by any other material. Each of these amino-moulding materials possesses its own specific advantages, but the immediate purpose of this article is to deal with dimensional stability under the varying conditions of atmospheric exposure with which their serviceability inevitably associates them.

It is generally known that mouldings produced from conventional urea powders "breathe" upon exposure. Generally, there is a tendency to shrink when subjected to dry conditions, or to slightly elevated temperatures, and to expand when exposed in humid or damp atmospheres. In short, dimensional movement occurs. The extent of this cannot always be predicted, because to some extent it is influenced by the degree of exposure of the moulding granules before use, by the moulding process conditions, the direction in which the moulding pressure is applied, as well as being dependent upon the configuration and design of the moulding itself, particularly the presence or absence of sharp changes in shape and in thickness of section.

The result of these changes in dimension in many cases is of no consequence; in other cases it is of primary importance. If areas of the moulding are clamped under pressure, even by bolt, nut and washer, cold flow occurs and loosening may result. Tiles may shrink when conditions become warmer or dry, and thereby become loose or reveal objectionable gaps; under damper conditions, swelling may result and cause cracking or distortion. Changes in size or shape may be enhanced in equipment which generate heat, for example, equipment embodying lamps or electronic tubes. In practice, problems do arise from these causes, even under the conditions of "indoors" installation in this country.

Urea moulding powders, modified by the incorporation of an ingredient to give low after-shrinkage in mouldings that are to be employed under dry conditions, or those involving undue warmth have recently been developed. For successful results, these powders must be kept quite dry before use, being supplied in air-tight containers. If exposed in the moulding shop for any appreciable period, they should be pre-dried for about 30 minutes at 90 degrees C.

These modified ureas have been in successful use because the objective of their introduction has been achieved, i.e., small after-shrinkage under dry conditions. They appear to show no superiority under damp exposure.

The other amino group of moulding powders, the melamines, go a long way towards solving the difficulties in

Table 1.—Summary of Dimensional Stability Tests under Wet and Dry Conditions on Urea Mouldings.

Test conditions	Period of test (days)	Per cent. total change in weight	Parts per thousand total change in dimensions		
			Length	Width	Thickness
Mild fluctuating humidity and warmth	7	+ 1.7	+ 6.0	+ 6.3	+ 8
	30	+ 2.8	+ 9.0	+11.3	+16
Severe hot humidity at 70°C after pre-drying at 70°C.	1 (dry)	— 2.7	—11.3	— 6.3	—12
	1 (wet)	+ 4.3	+24.0	+ 5.0	+12
	2 (wet)	+ 6.9	+40.0	+15.0	+28
	3 (wet)	+ 8.0	+43.0	+25.0	+40
Water immersion at 25°C.	7	+ 3.0	+14.0	+ 7.5	+12
	30	+ 6.5	+25.5	+21.3	+28
Dry heat at 70°C.	7	— 6.0	—20.0	—17.5	—16
	30	— 7.3	—21.2	—20.0	—24

Table 2.—Summary of Dimensional Stability Tests under Wet and Dry Conditions on Urea Mouldings, Low After-shrinkage Grade.

Test conditions	Period of test (days)	Per cent. total change in weight	Parts per thousand total change in dimensions		
			Length	Width	Thickness
Mild fluctuating humidity and warmth	7	+ 3.4	+11.0	+ 8.5	+16
	30	+ 4.8	+16.0	+14.5	+28
Severe hot humidity at 70°C after pre-drying at 70°C	1 (dry)	— 0.7	— 2.7	Nil	Nil
	1 (wet)	+ 5.0	+25.4	+15.5	+36
	2 (wet)	+ 7.9	+38.0	+24.0	+52
	3 (wet)	+ 8.6	+49.3	+31.2	+60
Water immersion at 25°C	7	+ 4.5	+18.0	+ 9.5	+28
	30	+ 8.7	+32.5	+27.6	+60
Dry heat at 70°C	7	— 2.2	— 7.0	— 4.8	—4
	30	— 3.4	— 9.8	— 8.4	Nil

Table 3.—Summary of Dimensional Stability Tests under Wet and Dry Conditions on Paper-filled Melamine Mouldings.

Test conditions	Period of test (days)	Per cent. total change in weight	Parts per thousand total change in dimensions		
			Length	Width	Thickness
Mild fluctuating humidity and warmth	7	— 0.20	Nil	Nil	Nil
	30	+ 0.20	+ 1.5	+ 1.0	Nil
Severe hot humidity at 70°C after pre-drying at 70°C	1 (dry)	— 2.5	— 6.0	— 6.5	—6
	1 (wet)	— 0.4	— 2.0	— 2.5	Nil
	2 (wet)	+ 0.5	+ 2.0	+ 1.5	+ 2
	3 (wet)	+ 1.1	+ 3.2	+ 2.6	+ 6
Water immersion at 25°C	7	+ 2.1	+ 5.5	+ 5.5	+ 8
	30	+ 2.6	+ 7.0	+ 7.0	+12
Dry heat at 70°C	7	— 5.7	—17.5	—16.0	—16
	30	— 6.8	—22.0	—20.5	—24

Table 4.—Summary of Dimensional Stability Tests under Wet and Dry Conditions on Mineral-loaded Melamine Mouldings.

Test conditions	Period of test (days)	Per cent. total change in weight	Parts per thousand total change in dimensions		
			Length	Width	Thickness
Mild fluctuating humidity and warmth	7	—0.10	Nil	Nil	Nil
	30	—0.22	— 0.5	— 0.5	Nil
Severe hot humidity at 70°C after pre-drying at 70°C	1 (dry)	—0.15	— 0.5	— 0.5	Nil
	1 (wet)	—0.05	— 0.5	— 0.5	Nil
	2 (wet)	+0.05	Nil	+ 0.5	Nil
	3 (wet)	+0.05	Nil	+ 0.5	Nil
Water immersion at 25°C	7	+0.15	Nil	Nil	Nil
	30	+0.50	+ 1.0	+ 1.0	Nil
Dry heat at 70°C	7	—0.75	— 3.0	— 3.0	— 4
	30	—1.55	— 5.0	— 5.0	— 8

Table 5.—Effect on Dimensions of Urea Mouldings of Successive Treatments of Dry Heat, Normal Conditioning and Humidifying.

Nature of treatment	Sample No.	Dimensional change parts per thousand during *each* treatment			Total dimensional change from original, parts per thousand		
		Length	Width	Thickness	Length	Width	Thickness
(a) Dry heat at 90°C., for 3 days; *decrease* in dimensions	1	20.0	15.0	22.0			
	2	16.0	20.0	18.0			
	3	11.0	21.0	32.0			
(b) Conditioned at 70 per cent. humidity, 20°C., for 9 days; *increase* in dimensions	1	2.0	0.5	2.0	—18.0	—14.5	—20.0
	2	0.5	1.0	4.0	—15.5	—19.0	—14.0
	3	0.5	Nil	2.0	—10.5	—21.0	—30.0
(c) Humidity exposed for 4 days, (70 per cent. at 60°C., for 8-hour day, 100 per cent. for 16-hour night at 20°C.); *increase* in dimensions	1	2.9	2.5	5.2	—15.1	—12.0	—14.8
	2	1.0	2.8	1.0	—14.5	—16.2	—13.0
	3	Nil	1.9	7.0	—10.5	—19.1	—23.0
(d) As in (c) for further 17 days; *increase* in dimensions	1	2.8	2.5	5.0	—12.3	— 9.5	— 9.8
	2	1.5	1.7	7.0	—13.0	—14.5	— 6.0
	3	2.4	4.6	4.0	— 8.1	—14.5	—14.9

both directions of damp and dry conditions. They are available to-day in two types. One of these is a paper-filled moulding powder, in a wide range of pastel colour shades; the other is a heavily mineral-loaded grade of buff colour. The paper-filled melamine yields mouldings that show marked improvement in stability over the urea grades, and the mineral-loaded type exhibits exceptional stability.

Test results are discussed below on mouldings from each of the classes mentioned, the samples being subjected to wet, dry, and combined wet and dry conditions. Stability is assessed by recording changes in weight and dimensions, i.e., changes from the original values.

Typical stability test results are tabulated. Table 1 deals with the conventional paper-filled urea resin-base amino mouldings. Table 2 shows the modified urea resin type having "low after-shrinkage." Table 3 covers paper-filled melamines; Table 4, the heavily mineral-loaded melamines.

The mild fluctuating humidity and warmth conditions of test No. 1 comprise subjecting the specimens to an atmosphere of 70-75 per cent. humidity, and a temperature of 55-60 degrees C. during the eight-hour day period, then cooling off at night to atmospheric temperature; humidity rises to 100 per cent. with condensation upon the samples. This is not unduly exaggerating the conditions that often result in temperate climates during change from day to night during hot, humid spells.

Test No. 2 is much more drastic. The test pieces are first submitted to dry heat at 70 degrees C. for 16 hours, cooling off in the test oven for the remainder of the day. They are next submitted daily for 16 hours to 100 per cent. humidity at 70 degrees C., cooling off in the test cabinet for the remainder of the day.

Test No. 3 is the usual procedure of complete submersion in distilled water at room temperature.

Test No. 4 exposes the samples in a uniformly heated air-oven at 70 degrees C.

Under the mild humidity conditions of test No. 1, the ordinary urea mouldings gain appreciable weight by absorption, and increase in superficial dimensions, in the extreme to about 10 thou. per inch. Swelling in thickness is marked. The modified urea mouldings are rather worse and move on the average about 50 per cent. more. Both types of melamine are exceedingly good, with changes in weight and dimensions all negligible.

Under the severe humidity test No. 2, loss in weight and shrinkage in dimensions during the dry period, followed by gain and expansion, occur during the wet days. With the urea mouldings, these changes are comparatively large, and

Table 6.—Effect on Dimensions of Urea Mouldings of Successive Treatments of Hot Conditions, Normal Conditioning and Water Immersion.

Nature of treatment	Sample No.	Dimensional change parts per thousand during *each* treatment			Total dimensional change from original, parts per thousand		
		Length	Width	Thickness	Length	Width	Thickness
(a) Dry heat at 90°C. for 3 days; *decrease* in dimensions	1	20.0	15.0	22.0			
	2	16.0	20.0	18.0			
	3	11.0	21.0	32.0			
(b) Conditioned at 70 per cent. humidity, 20°C., for 9 days; *increase* in dimensions	1	2.0	0.5	2.0	—18.0	—14.5	—20.0
	2	0.5	1.0	4.0	—15.5	—19.0	—14.0
	3	0.5	Nil	2.0	—10.5	—21.0	—30.0
(c) Water immersion at 20°C. for 4 days; *increase* in dimensions..	1	2.2	4.4	16.0	—15.8	—10.1	— 4.0
	2	2.2	1.7	6.0	—13.3	—17.3	— 8.0
	3	1.0	5.7	4.0	— 9.5	—15.3	—26.0
(d) Water immersion at 20°C. for further 17 days; *increase* in dimensions	1	18.0	18.0	22.0	+ 8.5	+ 2.7	— 4.0
	2	16.0	18.0	22.0	+ 2.7	+ 0.7	+14.0
	3	9.0	9.0	14.0	— 0.5	— 6.3	—12.0

Table 7.—Effect on Dimensions of Urea Mouldings of Successive Treatments of Water Immersion, Normal Conditioning and Dry Heat.

Nature of treatment	Sample No.	Dimensional change parts per thousand during *each* treatment			Total dimensional change from original, parts per thousand		
		Length	Width	Thickness	Length	Width	Thickness
(a) Water immersion at 20°C. for 21 days; *increase* in dimensions ..	1	13.0	14.0	24.0			
	2	9.0	15.0	12.0			
	3	13.0	18.0	30.0			
(b) Conditioned 70 per cent. humidity, 20°C. for 9 days; *decrease* in dimensions	1	10.0	6.0	12.0	+ 3.0	+ 8.0	+12.0
	2	2.7	15.0	10.0	+ 6.3	0.0	+ 2.0
	3	7.0	14.0	6.0	+ 6.0	+ 4.0	+24.0
(c) Dry heat at 70°C. for 4 days; *decrease* in dimensions	1	22.0	22.0	28.0	—19.0	—14.0	—16.0
	2	17.0	10.0	18.0	—10.7	—10.0	—16.0
	3	17.0	27.0	20.0	—11.0	—23.0	—13.0
(d) Dry heat at 70°C. for further 17 days; *decrease* in dimensions ..	1	3.2	2.5	6.0	—22.2	—16.5	—22.0
	2	4.0	5.2	10.0	—14.7	—15.2	—26.0
	3	3.2	5.6	12.0	—14.2	—28.6	—25.0

even somewhat greater for the modified urea specimens. The changes with the paper-filled melamines are very low, and with the mineral-filled melamines, exceptionally low, for the former only being about one-tenth of the values for the urea materials.

Under complete water immersion conditions, the urea mouldings gain appreciably in weight by absorption, and dimensions increase, the ultimate superficial expansions being about 25 thou. per inch, with marked swelling in thickness. The modified urea mouldings show this tendency to a greater extent, i.e., the changes are at least 25 per cent. larger. The melamines naturally show a tendency in the same direction, but the paper filled grades only move about one-quarter of the extent of the urea material, while in the case of the mineral filled melamine, movement is negligible.

Finally, under dry heat conditions (Test No. 4) the conventional urea mouldings lose weight and shrink, the contraction being appreciable and of the order of 20/1000 inch per inch in length and width. It is here that the properties of the modified ureas are revealed, because the weight loss and dimensional shrinkages are only half those of the straight urea resin mouldings. In short, these mouldings do achieve their object in showing smaller shrinkage under warm dry conditions. The paper-filled melamines behave little differently from the ordinary ureas under these conditions, but the mineral-filled melamines perform very well, being clearly the best of the series, and twice as good as the modified ureas.

Summarizing the foregoing, it is established that, under the test conditions obtaining, the modified urea mouldings show

good stability under hot dry conditions (but not in hot wet atmospheres), and that only the mineral loaded melamines surpass them in this direction. Under wet, or hot wet, conditions the modified ureas are relatively poor, the paper-filled melamines are very good, and, of course, the mineral-filled melamines are excellent.

The amino mouldings can be rendered rather more stable by a post-moulding baking treatment, but the benefit obtained is one of degree rather than the imparting of complete stability. Thus, for service under dry conditions an oven baking at 90 degrees C. for three days is applied by some users. This represents only one of several heat-treatment processes employed. Tables 5, 6 and 7 present average figures for each of three types of component.

Table 5 shows the typical shrinkage values for the post-baking of three days at 90 degrees C. Naturally, there is a wide divergence in the figures given. The specimens were then conditioned in a typical normal atmosphere, and the small degree of recovery is shown. They were next exposed to the warm and cool, dry and wet humidity test, first for four days, then for 17 days. Under these not unduly severe conditions, appreciable recovery—of the order of 25 per cent.—is revealed.

In Table 6, the third and fourth stages embodied water immersion, and the ultimate result is shown as appreciable expansion in more than half of the dimensions. Under these severe conditions, the post-shrinkage treatment is beginning to be more than offset by the later exposure conditions.

In contrast with dry shrinkage, wet expansion may be a problem, i.e., the use of these mouldings permanently under wet or highly humid conditions. The data in Table 7 is intended to simulate the factors under these conditions. In the first instance, the mouldings are stabilized to wet conditions by water immersion. They are then given a normal conditioning treatment, i.e., not severe in temperature, dryness or wetness, and finally dry-heat conditions at a moderate temperature of 70 degrees C. It will be seen that the conditioning brings back at least 50 per cent. of the change due to water immersion, and that dry heat quickly negatives the influence of the latter. In other words, water immersion cannot produce stability for other than similar conditions of submersion, and it is useless for subsequent exposure in humid atmospheres or subjection to moderately elevated temperatures.

Melamine mouldings claim a number of distinctive advantages, and it must be granted that these have been substantiated in practice. They include good colour in a variety of shades, including light tints, and retention of this colour under service conditions which may include damp and dryness, heat or light; rapidity of cure to a hard moulding; resistance to staining, abrasion, water and dampness; good resistance to heat, and to arc and flame; high mechanical properties, especially to shock and impact; and good electrical characteristics with especially high resistance to tracking.

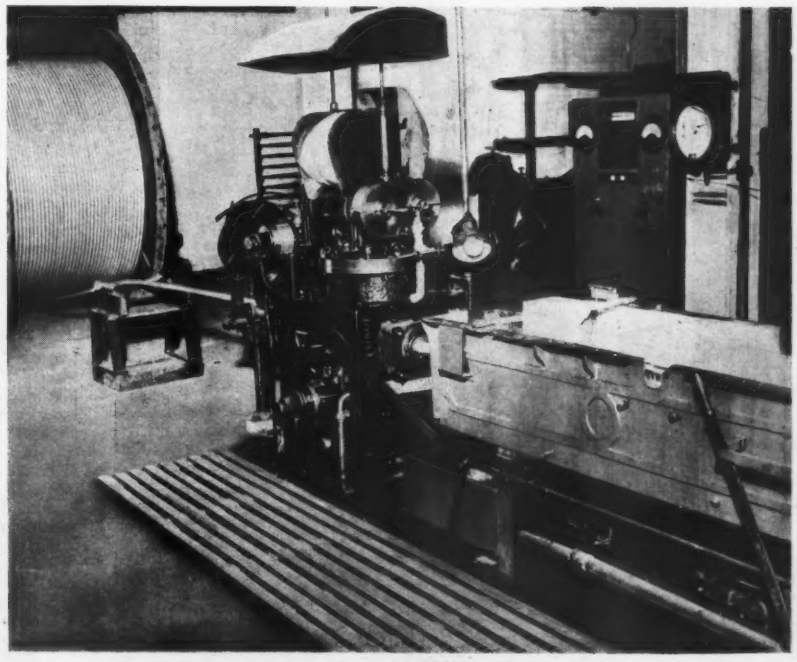
In all these respects the melamines are at least equal to the ureas, and in most of them superior. Hardness, resistance to water and heat, and electrical properties are all of higher order. For example, insulation resistance between inserts at 1¼-in. centres in paper-filled melamines is still infinity after 24 hours' water immersion.

The modified ureas for low after-shrinkage can be selected when the user is assured of service atmospheres that are conditioned to continuous dryness. The paper-filled melamines give superiority for normal purposes with their better water resistance. The mineral-filled melamines answer the need for a material giving stability under all the variables of wetness and dryness and temperature-stability of strength and electrical properties. In this country at present, this grade of moulding is available only in a buff or brownish colour, and thus the requirement for colour shades is not satisfied. A definite need exists for a medium mineral-filled or mineral-plus-paper-filled melamine, to satisfy this demand with almost the full stability offered by the mineral-filled types. Such a material has proved its value in America, and it is considered that development should be expedited in this direction. It is deemed that such a material would be largely complementary to the urea types, but even if it substituted them to a large extent, it is still felt to be a sound development and a mark of progress.

Atlantic Cable

THE renewal of the trans-Atlantic submarine cable between Porthcurno and Nova Scotia was completed last month by H.M. Telegraph Ship "Monarch" (8,000 tons) chartered by Cable and Wireless, Ltd. Laid from Porthcurno in 1874, the original cable became unserviceable in 1943. 800 miles of cable have now been replaced between Porthcurno and Harbour Grace, Newfoundland and 400 miles of cable were laid between Harbour Grace and Halifax.

It is the first trans-Atlantic cable in which "Telcothene" (polythene processed by Telegraph Construction and Maintenance Co., Ltd., to provide specific characteristics) has replaced gutta-percha as an insulating material. The cable has been manufactured by Submarine Cables, Ltd., owned jointly by Siemens Bros. and Co., Ltd., and The Telegraph Construction and Maintenance Co., Ltd., at Telcon Works, Greenwich. The cable consists of a solid copper conductor weighing 700 lb. per nautical mile, insulated with "Telcothene" weighing 340 lb. per nautical mile and sheathed with galvanized steel wires and yarn outerserved. Our illustration shows one of the extrusion machines used for covering the conductor with "Telcothene" polythene insulation.

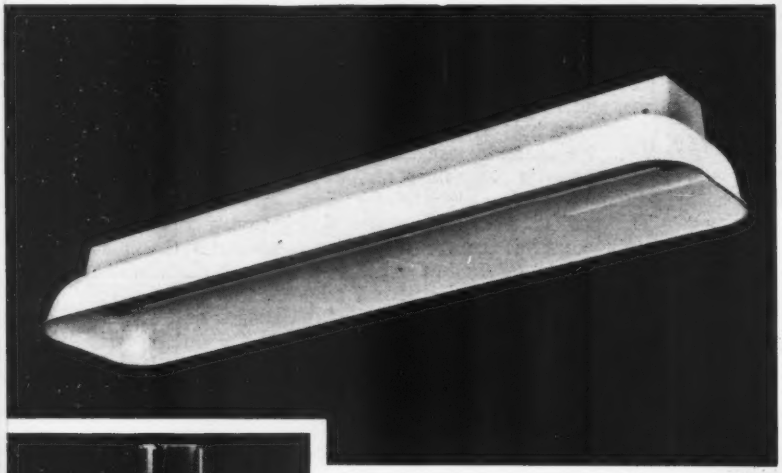


PLASTICS
IN THE SERVICE OF MAN

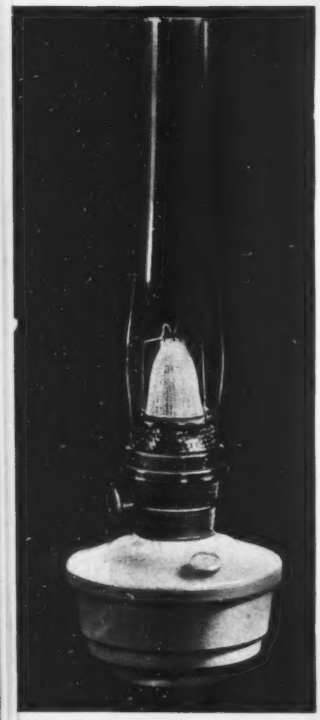
A pictorial review of high-quality units moulded or otherwise fabricated in Great Britain . . .

32. Interior Lighting

(Above) Lighting supplied by General Electric Co., Ltd., for the Pontypool factory of British Nylon Spinners, Ltd., includes 600 "Perspex" trough reflectors for 5 ft. 80-watt fluorescent tubes.



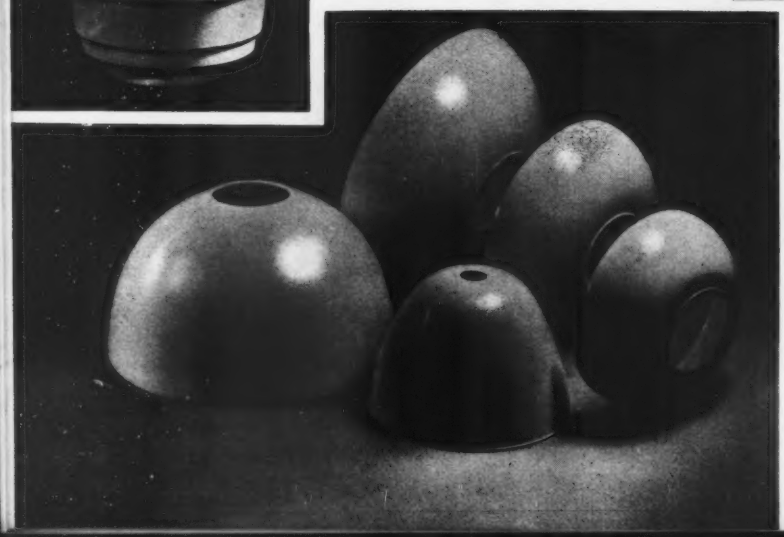
(Below) "Bakelite" phenolic cement is used to bond the metal cap to the glass of "Osram" electric light bulbs. 48 lamps circulate at one time on this "basing" machine at the works of General Electric Co., Ltd. (Photo: Bakelite, Ltd.)



(Above) Opaque white "Cobex" vinyl sheet manufactured by B.X. Plastics, Ltd., is used to form the trough reflector for this fluorescent fitting.

(Left) The base, lid and filler cap of the oil-burning table lamp manufactured by Aladdin Industries, Ltd., consist of stove-enamelled phenolic mouldings produced by W. W. Ball and Sons, Ltd.

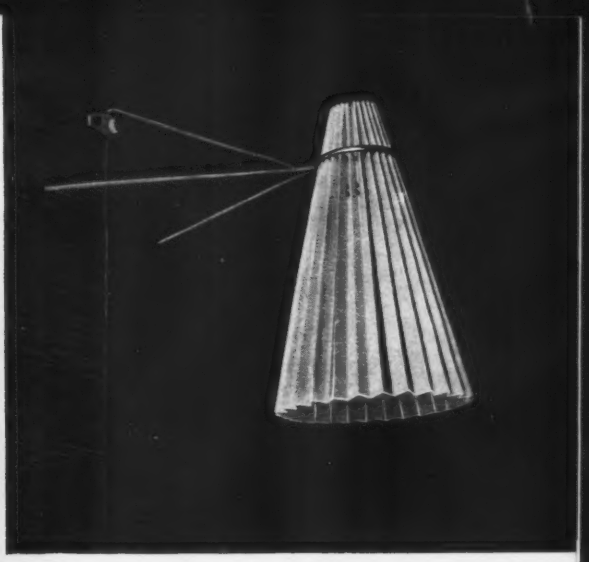
(Below) The range of lampshades moulded by E. K. Cole, Ltd., Plastics Division, include the injection-moulded white acrylic shade on the left, and the four white urea shades on the right.



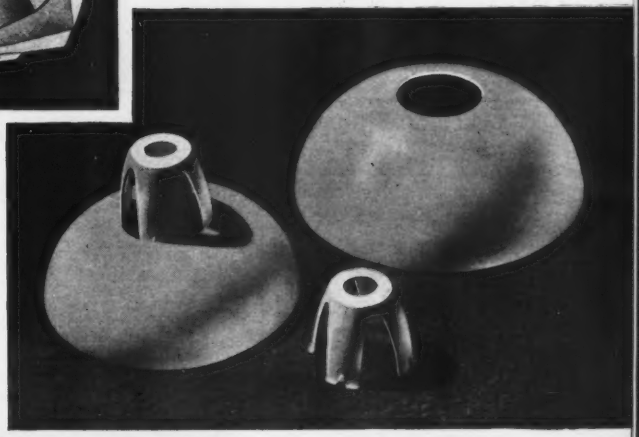
(Right) Components made by British Moulded Plastics, Ltd., for the "Gripper" handlamp of British Central Electrical Co., Ltd., include the spring-loaded handle in reinforced phenolic material and the guard moulded in two pieces from polythene.

(Above) Peach and ivory "Crinothene" (I.C.I.'s embossed polythene sheeting) is used for the shades of the "Versalite" ring pendant manufactured by Troughton and Young (Lighting), Ltd.

(Below) Pendant lighting fitting made by General Electric Co., Ltd., with lampshade manufactured by Chrysaline, Ltd., by spraying a white plastics skin on a wire framework.



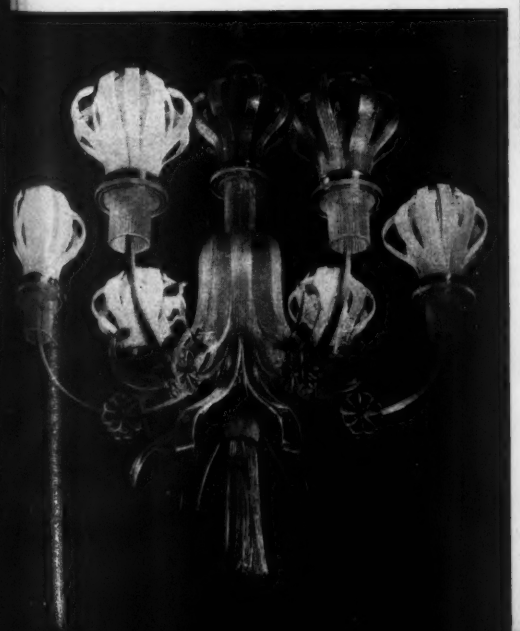
(Above) This modern wall fitting made by the Cone Fittings Co., Potters Bar, has a pleated lampshade made from 0.010-in. cream cellulose acetate sheet produced by Utilex, Ltd.



(Above) Lampshades for Benjamin Electric, Ltd., are moulded in "Beetle" urea material by Streetly Manufacturing Co., Ltd. (Photo: B.I.P., Ltd.)

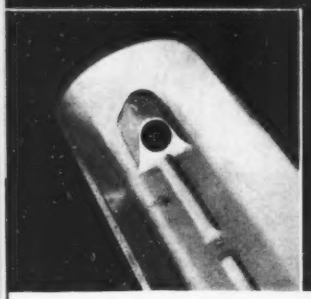
(Above) This decorative fitting for fluorescent tubes manufactured by General Electric Co., Ltd., employs a louvre built up from polystyrene mouldings in egg-box fashion.

(Above) 10-in. diameter urea lampshade moulded by Ashdowns, Ltd.

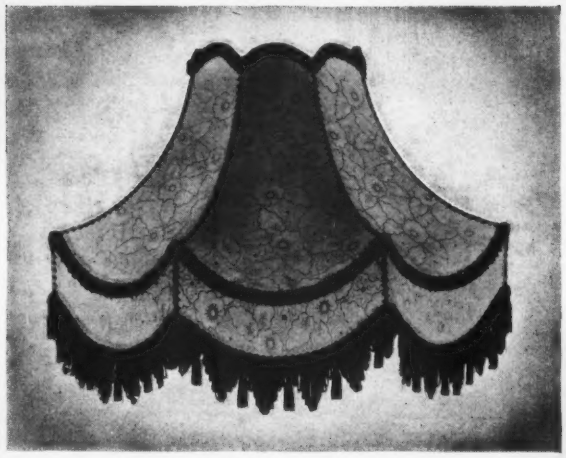


(Left) Pendant lighting fitting manufactured by Falk, Stadelmann and Co., Ltd., using transparent "Perspex" strips as decorations.

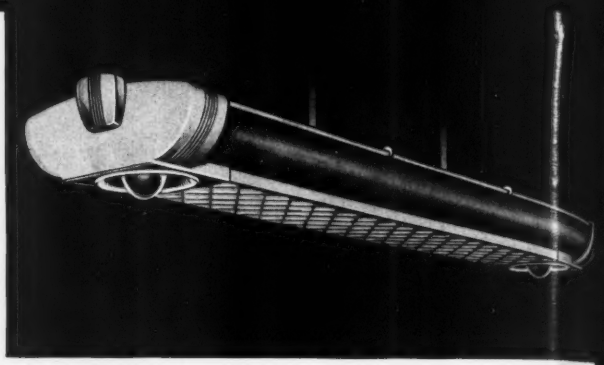
(Right) "Perspex" decorative chandelier made by Strand Electric and Engineering Co., Ltd., for Riverside Theatre, Battersea Pleasure Gardens.



(Above) The white "Perspex" trough reflector for fluorescent tubes, manufactured by Wokingham Plastics, Ltd., has a specially designed integrally formed portion (inset) to contain the end fittings for the tubes.

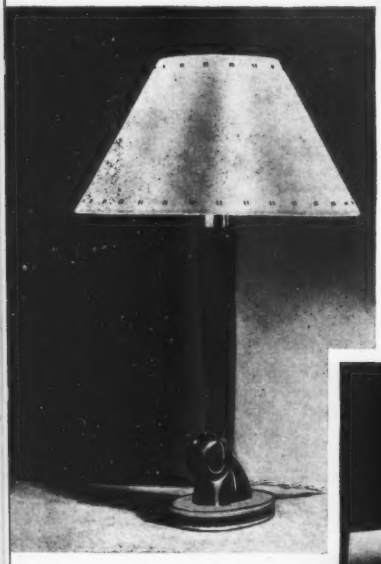


(Above) Lampshade manufactured by the Modern Lamp and Shade, Co., Luton, employs "Celastoid" cellulose acetate sheeting produced by British Celanese, Ltd., with silk-screen printed lace pattern.



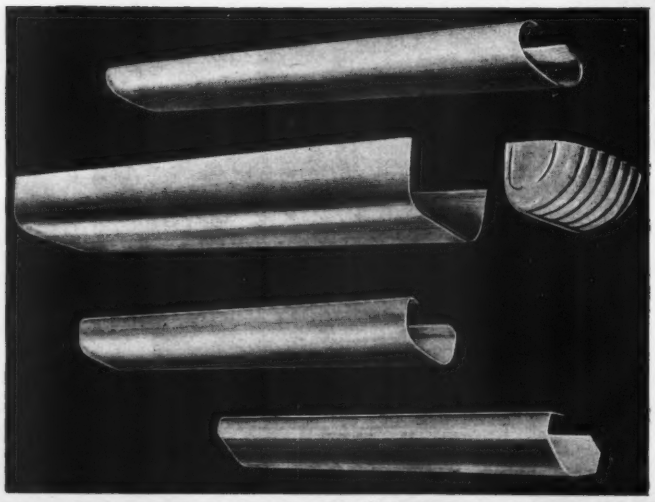
(Above) Instant self-starting lighting units made by Philips Electrical, Ltd. combine fluorescent and tungsten filament lamps. A decorative plastics louvre and "Crinothene" side panels are used in this model.

(Below) This table lamp manufactured by General Electric Co., Ltd. in co-operation with W. S. Chrysaline, Ltd. has a "Chrysaline" shade produced by spraying a translucent plastics skin on a wire frame.



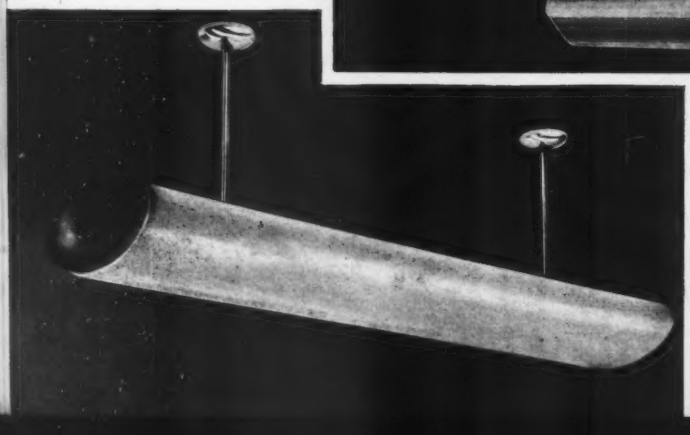
(Left) Table lamp designed and manufactured by J. Starkie Gardner, Ltd. with stem of "Catalin" cast phenolic resin (Catalin, Ltd.) and shade of "Bexoid" (BX Plastics, Ltd.) cellulose acetate. ("Plastics," July 1947, p. 346.)

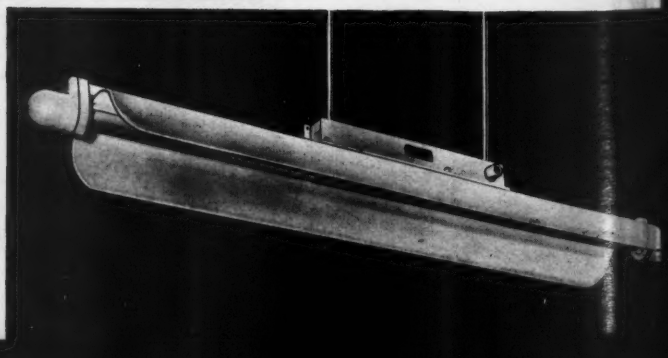
(Left) Reeded "Perspex" diffusers and end fittings for fluorescent lighting fittings are fabricated by Phipps Plastic Products, Ltd.



(Below) A reeded "Perspex" diffuser is incorporated in this pendant for two fluorescent tubes manufactured by Merchant Adventurers, Ltd.

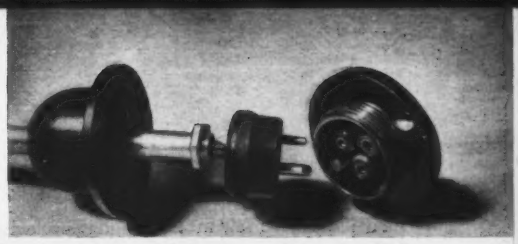
(Below) Rigid polyvinyl chloride is used as an alternative to vitreous enamelled steel or "Perspex" in the open reflector on this pendant manufactured by Crompton Parkinson, Ltd. The material has many advantages at temperatures below 100 degrees F.





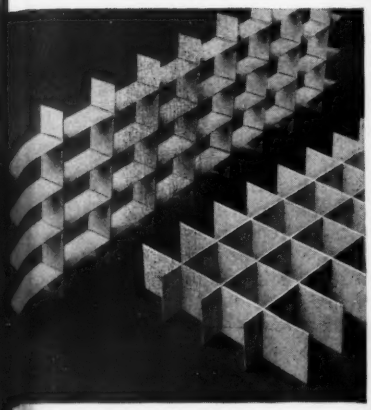
(Above) Both the brown phenolic and the cream urea moulding are moulded by Crystalate, Ltd., for use in lighting fittings on British Railways.

(Right) This ceiling fitting, moulded by Ranton and Co., Ltd., from phenolic material, can be disconnected as shown for ease of maintenance.



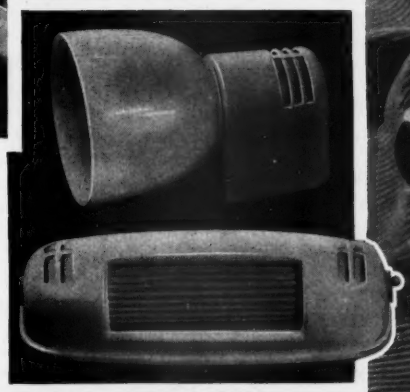
(Left) Berth lamp and shade are both moulded in urea material by Brookes and Adams, Ltd.

(Above) Decorative end fitting in polystyrene and fluorescent tube holders in urea (centre) are moulded by the plastics division of E. K. Cole, Ltd., for use in the company's lighting fittings.

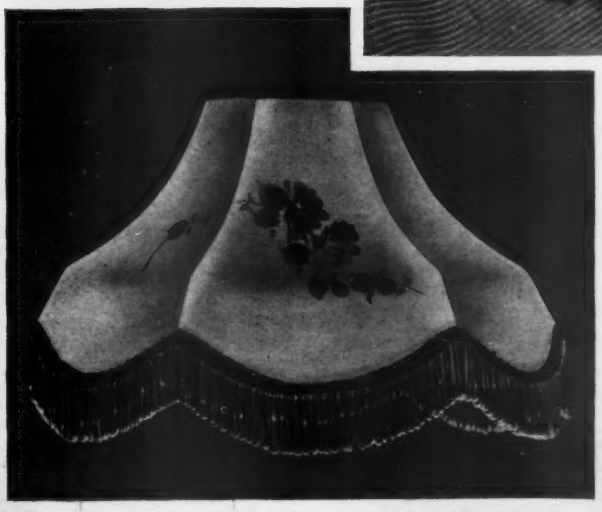


(Above) "Egg-box" louvres for lighting fittings are fabricated by Thermo-Plastics, Ltd., from "Cobex" vinyl copolymer sheet manufactured by BX Plastics, Ltd.

(Right) Two berth lights for Orient Line ships, moulded by Roanoid Plastics, Ltd.



(Below) 7-ft. open trough reflector fabricated by Ashdowns, Ltd., from white "Perspex" for a lighting fitting by Edison Swan Electric Co., Ltd.



(Above) "Lactoid" casein material is still chosen for fabricating switches and similar components where colour and finish are important. These components are machined by Mosses and Mitchell, Ltd. (Photo: BX Plastics, Ltd.)

(Below) Electrical components manufactured by Ashley Accessories, Ltd., include a festoon striplight holder and junction boxes moulded from "Bakelite" phenolic material. (Photo: Bakelite, Ltd.)

(Above) This hand-painted lampshade manufactured by Barber and Tytheridge, Ltd., is produced from p.v.c. sheet by high-frequency welding.

Plastics at the Farnborough Show

THERE can be few more thrilling spectacles than the annual flying display arranged by the Society of British Aircraft Constructors at which the member manufacturers show the world the advances made during the past year. The contribution that the plastics industry makes towards aircraft construction is generally not apparent to the general observer, but there is no doubting now its essential nature and the certainty of its growth.

Less than 10 years ago a well-known aircraft designer told the plastics industry that apart from its use in a few components, plastics would never be used for structural purposes. And yet to-day the Comet jet air-liner owes part of the strength of its structure to bonding of metal structures with synthetic resins, while certain units are made of glass-fibre laminates of adequate stiffness and strength. Modern transport aircraft are being lined with panelling for both utility and decorative value, and last year the Royal Aircraft Establishment produced a complete experimental " delta " wing of " phenolic " asbestos structure that will in due course be tested in the air. This latter at least must have surprised and confounded the aforesaid designer.

At this year's show we were particularly interested in the use of the new epoxide resins by the R.A.E.

The exhibit illustrated an investigation, at present in progress, into the use of synthetic resin as adhesive and surface coating material, with the object of developing a method for the manufacture of wind-tunnel models. The process aims to effect economy in time and labour, compared with the making of all-metal models, without sacrifice of dimensional accuracy or strength and stiffness. The tedious machining of metal is eliminated by commencing with an undersize metal blank or casting and building up with a proprietary epoxide resin which can then be worked down to accurate profile. The process, originally conceived in the laboratory, is now performed in a development workshop equipped with spray booths, a large hotplate with overhead infra-red heating accessories, electric ovens and facilities for shaping; these items enable trained personnel to use various grades of hot or cold setting epoxide resins with or without addition of solvents, plasticizers, fillers and pigments.

In making laminated models, aluminium alloy sheet is degreased and pickled according to Specification D.T.D.915A. If steel sheet is used instead, it is degreased and if necessary derusted by chemical or mechanical means. The clean metal sheet is heated to 110 degrees C. and rubbed with a stick of hot-setting resin or sprinkled with a powdered resin. The laminæ may then be placed in contact and the resin cured in three hours at 160 degrees C. Alternatively, in composite construction, the resin may be cured on the separate laminæ, which are then bonded with cold-setting resin; this method is convenient in assembly and gives good adhesion, especially if the product is heated to 60 degrees C. to complete the cure of the cold-setting resin. High pressures are not required for bonding, which is done by means of vacuum-bag techniques.

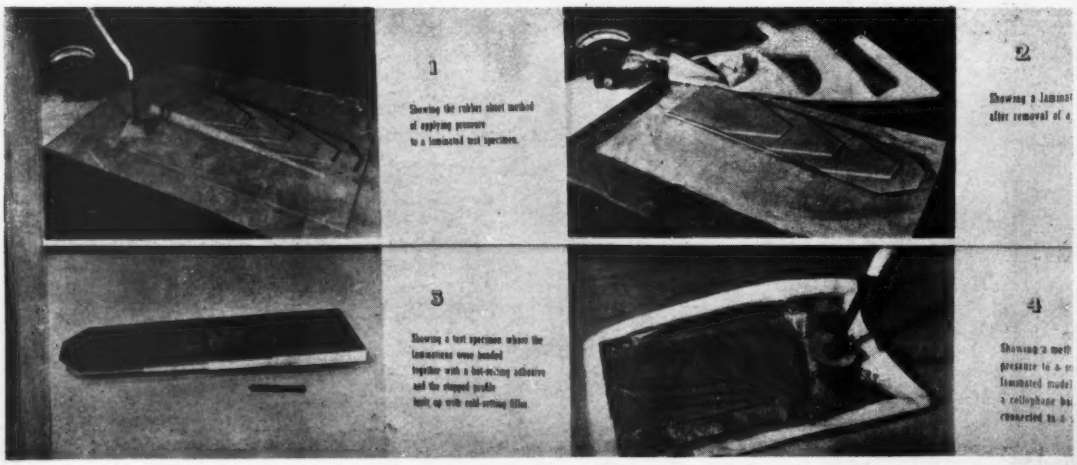
The stepped profile of the laminated product is built up with hot- or cold-setting resin to the approximate (oversize) aerofoil profile required. Alternatively, a suitable metal casting may be used as a basis for the build-up process. The hot-setting resin is applied as a liquid or powder spray, the latter by means of a Schori flame or by hand sprinkler. The cold-setting resin mixed with an inert filler to paste consistency is applied with a spatula. The cured resin is finally worked down to accurate aerofoil profile.

The photograph seen below displays the various techniques employed.

Another exhibit which shows the increasing interest by aircraft constructors in plastic moulding materials was that of the Bristol Aeroplane Co. It is a representative fuselage component produced from four asbestos-phenolic mouldings. The shell is made by the " Bristol " low-pressure moulding technique and three pressure-moulded diaphragms are glued into the shell to complete a fuel tank and wing mounting.

I.C.I. Plastics Division displayed examples of plasticized and unplasticized " Perspex " and of " Nuron " laminates. The working properties of " Perspex " were shown on large graphs —these included curves illustrating maximum operating temperatures of shaping, comparative tensile cold flow, stress at break and comparative shapeability.

Triplex Safety Glass Co., Ltd., exhibited a large range of special safety glasses and " acrylic " products, including laminates resistant to bullets and others with de-icing and de-misting properties. A vinyl compound is used as an interlayer between " Perspex " laminates. Cobex is employed by Triplex for the interior panelling of aircraft. Thermo-Plastics, Ltd., exhibited a range of glass-fabric laminates and examples of " Perspex " bonded to rubber and the latter to metal. The Percival " Prince " telecommunication aircraft with its glass/fabric polyester resin radome made by Thermo-Plastics, Ltd., was on view on the aerodrome.



Panels at the R.A.E. stand illustrated the building-up of metal laminates with epoxide resins.

High Frequency Preheating

By S. R. HAWKINS*

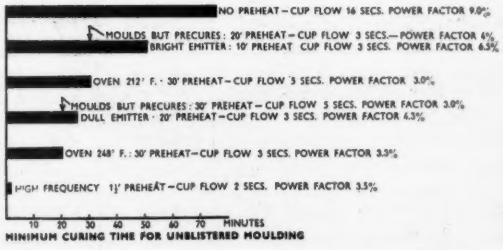
The author provides practical notes and some analyses of actual productions of preheated mouldings for guidance in the moulding shop.

ALTHOUGH a comparatively recent development as an accessory to the moulding of thermosetting powders, the radio or high-frequency oven has obtained for itself an eminence which has been reached by few other mechanical or electro-mechanical devices in so short a time. Before 1940 the system was practically unheard of; in 10 years the use of r.f. preheating has become an accepted necessity in the up-to-date shop. It has been described as the greatest step forward in the thermosetting plastics industry since the development of urea powders, and now leads far beyond the actual production line. Designers of plastic articles are now specifying "r.f. preheating" as other engineering draughtsmen label their drawings "This edge to be milled" or "Finish—Stove enamelled." Before quoting for a part the estimator now wants to know whether or not the moulding will be made in conjunction with an r.f. oven, and takes steps to check the availability of the necessary plant, otherwise he may find his estimates sadly out—either the price will be too dear, or the contract, having been priced on the assumption that preheating would be used, will prove uneconomic. Before going more fully into the uses and advantages of r.f. preheating, we would like to reprint an extract from the excellent article by Mr. H. H. Ball, published in the January, 1952, issue of Plastics Institute Transactions. We are indebted to Messrs. Bakelite, Ltd., and the Plastics Institute for permission to publish the extract and illustration.

"The Value of Preheating"

"Any form of preheating, as an aid to moulding, can really only be considered beneficial and worth the necessary expenditure if its use leads either to a reduction in the cost of production or to a significant improvement in the standard of the mouldings which are made.

"Considering the first of these provisos, reduction in press closing and cure times, the reduction of flash thickness and improvement of surface finish all help in reducing costs. Preheating of phenolic material, providing it is correctly carried out, will certainly result in thinner flash lines and in brighter, smoother surfaces to mouldings, while its value in reducing press closing times and cure time is illustrated below."


NO PREHEAT – CUP FLOW 16 SECS. POWER FACTOR 9.0%
MOULDS BUT PRECURES: 20' PREHEAT – CUP FLOW 3 SECS. – POWER FACTOR 4%
BRIGHT EMITTER: 10' PREHEAT CUP FLOW 3 SECS. POWER FACTOR 6.5%
OVEN 212° F. · 30' PREHEAT – CUP FLOW 3 SECS. POWER FACTOR 3.0%
MOULDS BUT PRECURES: 30' PREHEAT – CUP FLOW 5 SECS. POWER FACTOR 3.0%
DULL EMITTER · 20' PREHEAT – CUP FLOW 3 SECS. POWER FACTOR 6.3%
OVEN 248° F.: 30' PREHEAT – CUP FLOW 3 SECS. POWER FACTOR 3.3%
HIGH FREQUENCY 1½' PREHEAT – CUP FLOW 2 SECS. POWER FACTOR 3.5%
10 20 30 40 50 60 70 MINUTES
MINIMUM CURING TIME FOR UNBLISTERED MOULDING

Effect of method of preheating on curing time, cup flow and power factor.

It will be seen from the above diagram where the test moulding was a 3-in.-diameter disc 1 in. thick, the material being black general-purpose phenolic powder, that both the shortest preheat time and the shortest curing time were obtained by the use of radio frequency equipment.

* Radio Heaters, Ltd.

General Advantages

In conjunction with a number of well-known firms in the plastics moulding industry, we give on page 296 a table showing some of the actual advantages obtained on a variety of mouldings.

Reference to this table will show that perhaps the most interesting improvement is that, on the average, the output is almost doubled—in the best examples given the output is increased by 150 per cent.: in the least favourable by 35 per cent. For example, a moulded door knob—an article on which radio preheating is now almost universally employed—shows an increased output of between 250 per cent. and 300 per cent. On economic grounds radio preheating is essential on all mouldings of ¼ in. or over in maximum thickness.

Other advantages may be summed up as follows:

Pin Breakages Eliminated

One example is shown in the table. The introduction of radio preheating enabled 350,000 mouldings, each with four screwed 8BA pins to be moulded without a single pin breakage. Other firms have reported that, whereas moulding tools have been returned to the tool room for an average of two days per working week for repairs on slender insert pins, the introduction of preheating has completely eliminated this waste of production time and costly labour.

Polishing Unnecessary

With a good tool surface and with powder preheated to the correct temperature, the added lustre which can be obtained on the finish of a moulding is most marked. Smoother, brighter surfaces are obtained, making after-polishing unnecessary, and the thinner flash lines reduce "fettling" to a minimum.

Heavy Mouldings Made Easier

Most designers of plastic articles now realize the added advantage which preheating gives them in the scope of their work. Thicker sections, which before were carefully avoided, are now cheerfully accepted as all part of the day's work, and it is this, perhaps, more than any other factor which has

Fig. 1.—High frequency preheating of preforms for phenolic spinning pot mouldings. (Photo: Courtaulds, Ltd.)

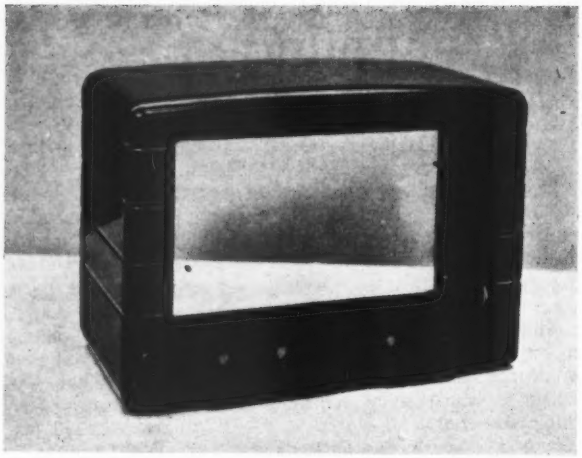


Fig. 2.—Output per hour on this radio cabinet moulded by Moulded Products, Ltd. was doubled by using r.f. pre-heating. Pressure was reduced from 750 tons to 400 tons. (See table below)

resulted in the increased strength of plastics mouldings. Since the preheated powder is very nearly at curing temperature when placed in the mould (preheating temperatures of 110 degrees to 130 degrees C. are not uncommon), it follows that very thick sections can be completely cured. As an example, a ball some 4 ins. diameter is now being moulded without any sign of cavity or blistering with a curing time of between 10 and 15 minutes. Previously several hours' curing time was necessary, and even then a cut section showed that the centre of the ball was far from cured.

Electric Power Saving

Many firms consider that because a radio frequency preheating unit draws current from the mains, then the installation of such units is bound to cause a rise in the overall consumption of electricity in the factory. This must be considered in perspective and an investigation has shown that, whilst the installed load may be somewhat higher, the actual units of electricity consumed per moulding are far lower, thus enabling a saving of electricity power costs. One example from many can be quoted. A moulding press producing a 4 lb. radio cabinet was consuming 7 kW on its platens. By using an r.f. generator with an output of 1¾ kW the number of lifts per hour was increased from 10 to 18. The radio heater itself was consuming 3 kW under load and 200 watts between heating cycles. With a 2½-minute heating cycle and 18 lifts per hour, the average power consumed by the radio heater was found to be 2.3 kW per hour. The total power consumed to produce each moulding was, therefore,

$$\frac{7\text{ kW} + 2.3\text{ kW}}{18\text{ lifts}}$$

i.e., 0.5 kW hours. Unaided by radio preheating, the power consumption per moulding was .7 kW hours. It will, therefore, be seen that the power saving when using radio preheating was thus over 26 per cent.

Lower Moulding Pressure

Due to the excellent flow resulting from uniform plasticizing of the powder, it is possible to work at considerably reduced moulding pressures. Existing presses will, therefore, deal with larger mouldings. This is shown in the details given by Messrs. Moulded Products, Ltd., Birmingham, of the radio cabinet in Fig. 2.

The Turner Manufacturing Co., Ltd., carried out an interesting experiment whilst designing their 125-ton moulding press. They used as a test moulding a toilet seat which was normally impossible to mould with a pressure of less than 350 tons. They found that by radio frequency preheating the powder (general-purpose black phenolic) the moulding could be easily produced with a maximum pressure of 125 tons. As a result of their tests, it was decided to substantially increase the area of the platens fitted to their press.

New Applications for Plastics Materials

During the recent shortage of die-casting metals a number of manufacturers went over to phenolic mouldings and there is evidence that, although the metal situation has eased, the new-found applications for plastics have come to stay. The necessary strength can now be obtained by increasing the thickness of the section, and it will be seen that preheating enables moulders to tender for articles previously considered unsuitable for production in moulding materials.

Using Radio Frequency Ovens

Just as it is possible to purchase different makes of cars, all of which have their own peculiarities as to the number of passengers they can carry, the size of the engine, the speed they can travel, etc., so it is possible to purchase a widely differing variety of radio frequency ovens. Indeed, any manufacturer who sets himself out to serve the plastics moulding industry must be prepared not only to have a full range of equipments, but also to modify those equipments if necessary for special applications.

The ideal radio frequency oven for plastic preheating

Effect of r.f.-pre-heating on Cure Time and Output of Selected Mouldings.

Company supplying information	Moulded Products, Ltd.	Moulded Products, Ltd.	The Streetly Manufacturing Co., Ltd.	The Streetly Manufacturing Co., Ltd.	Engineering and Lighting Equipment Co., Ltd.	Courtaulds, Ltd.	British Moulded Plastics, Ltd.	British Moulded Plastics, Ltd.	Westinghouse Brake and Signal Co., Ltd.
Moulding selected	Radio cabinet in phenol	Quartz crystal box in phenol	Iron handle in X20/5 black phenol	Mug moulding in Q4100 melamine	Knife trays in phenol	Spinning box in phenol	Radio Cabinet in G.P. phenol	Meter cover in phenol	Plug-in relay base in phenol X20/5
Weight of moulding	7½ lbs.	1 oz.	5.15 ozs.	3.4 ozs.	2½ lbs.	4 lbs.	3 lb.	14¾ ozs.	1 lb. 14 oz.
Maximum thickness of moulding	⅛ in.	5/16 in.	1¼ ins.	¼ in.	½ in.	¾ in.	⅛ in.	¾ in.	1 in.
Original cure time	8 mins.	3 mins.	4 mins.	1½ mins.	10 mins.	20 mins.	6-7 mins.	6 mins.	Unmouldable
Cure with radio pre-heating	3½ mins.	2 mins.	1¼ mins.	50 secs.	5 mins.	17 mins.	3 mins.	3 mins.	7 mins.
Original output per hour	4 to 5	Not possible due to pin breakage	11	26	5	2	5	4	Unmouldable
Output per hour with radio pre-heating	10	15	23	35	8	3	11	7	7
Radio pre-heating time	6 mins.	1 min.	40 secs.	40 secs.	2½ mins.	4 mins.	3½ mins.	1½ mins.	4 mins.
Remarks	Pressure reduced from 750 tons to 400 tons. Finish greatly improved	4 screwed pins 8 B.A. 350,000 mouldings without single pin breaking	Transfer moulding	—	—	Pin breakage reduced to nil. Scrap figure eliminated owing to improved flow	Very good finish	Very good finish. No pin breakage	Impossible to mould without pre-heating owing to helical inserts

would be one which would be capable of accepting any load from single small pellets to 10-12 lb. of any material, ranging from undensified urea, through the range of pelleted phenolics, to large flake material of any type for radio and television cabinet manufacture. It should be capable of dealing with this range without tuning and substantially without the need for altering the power output control, the heat being controlled solely as a function of time. It is admitted that even the most modern of present-day preheating ovens falls far short of this ideal, and such are the technical problems involved both in the manufacture of certain components, such as valves, and the vast electrical differences in the powders that it seems extremely unlikely that such an ideal will materialize. Used correctly, however, the modern radio frequency preheating oven is a facile and flexible instrument, and the following notes are designed to assist the moulder to obtain the best possible use from his equipments. Although it is intended to be as non-technical as possible, it is hoped that the explanations of technical terms used will enable the average moulder to follow the processes. Taking an average preheating oven to pieces, the general sections are as follows:—

1. **The Power Pack.** This is generally referred to as the low-frequency side of the equipment and deals with the electricity coming from the mains, where it is transformed into both higher and lower voltages than the mains supply for feeding various parts of the oscillator valves, and in the case of the higher voltages this is rectified from the alternating current of the mains to direct current. The high voltages emitted vary with the size of the equipment and the power output required, and would be from 2,500 to 6,000 volts. It will, therefore, be realized that these voltages are dangerous, and it is the practice of the manufacturers to ensure adequate safeguards by means of a series of linked switches so that these high voltages cannot be " on " when any of the doors to the cabinet are open.

2. **The Oscillator Section.** This is where the high and low voltages are applied to the main oscillator valve, which transforms the energy into a rapidly oscillating current which may have a change-over rate (or frequency) of approximately 35 million times per second. It should be noted that at this frequency, although the power is considerable, it is impossible to get an electric shock from any part working at this frequency, but an electric burn, not shock, could result if a live part were touched. There is no shock because the frequency is so high and the reaction so fast that it fails to stimulate the nervous system. Here, again, the manufacturers have adequate safeguards to ensure that the operator cannot touch any part of the instrument carrying r.f. currents.

3. **The Oven.** This is the chamber into which the powder is put and consists of an insulated electrode which carries the high-frequency current and an earthed electrode which is earthed in common with the chassis of the whole unit. Sometimes an earthed electrode is the lower one, and sometimes it is the higher; for practical purposes this is not important, although in certain cases the earthed lower electrode is to be preferred. The size of the electrode is determined by the frequency and power of the equipment, and the manufacturer's guidance on this point should be asked before getting a larger electrode than that supplied with the equipment.

4. **Controls.** These may be briefly described as follows:—
   (a) On/off switch. This isolates the equipment from the mains.
   (b) Timer. An electronic or synchronous motor timer is usually employed, the r.f. power cutting off at the end of the time cycle and the timer resetting itself automatically to repeat the process. This is usually linked with the switches operated by closing the oven lid.
   (c) Power output control. Two main types are in use. The hand-wheel type which taps off a coil in the oscillator compartment, and the condenser type, which tunes the equipment by bringing the moving electrode nearer to the load. It is important for the correct functioning of the equipment always to reduce the power to zero before tuning up on an unknown load. Once the power output has been set, however, it can remain so for each operation on the same load of moulding powder.

   This is not generally realized, especially when the day operator on a job likes his 12 pellets stacked in four sets of three, and the night-shift worker prefers his (same 12 pellets, same weight of powder) stacked in three sets of four! Different stacking results in different electrical characteristics on the same weight of powder. Further reference is made to this point in another paragraph.
   (d) Electrode height adjustment. This is usually on top of the oven and directly controls the upper electrode. In general the " air-gap " between the top of the material and the electrode should be as small as possible.

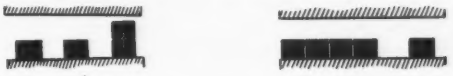
Faults in Oven Usage

Failure to preheat evenly

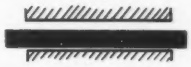
(1) Electrode not parallel.

(2) Stacking not even (in height) and

(3) Stacking not even (in separation).

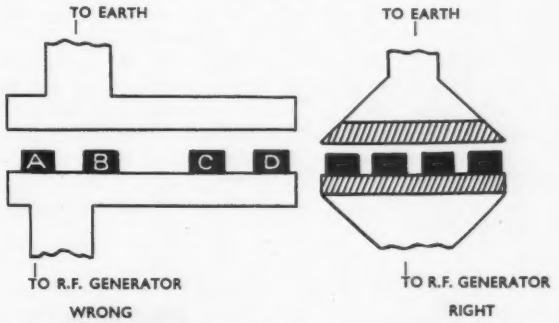


(4) Powder container overhanging electrode.



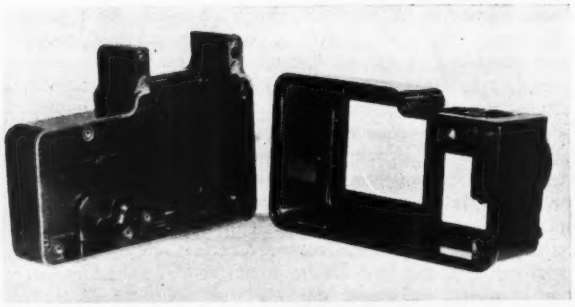
(5) Powder containers not square with electrodes.

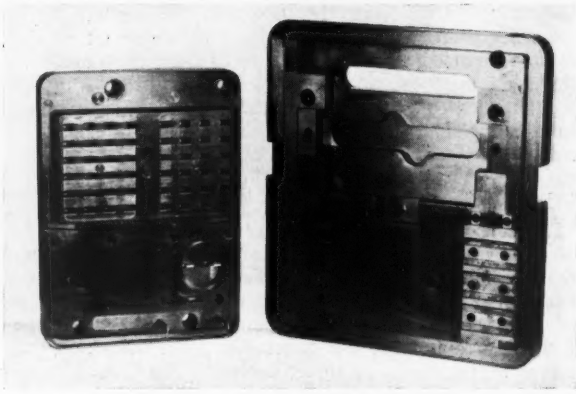
(6) Power not fed properly into electrodes.



Pellets A and B will heat at a faster rate than C and D.

Figs. 3, 4, 5. — Further mouldings which have been moulded with greater efficiency by use of r.f. preheating (see table): 3. (Right) Meter base and cover. (British Moulded Plastics, Ltd.) 4. (Below) Radio cabinet (British Moulded Plastics, Ltd.) 5. (Below, right) Searchlight top-plate and relay base.





Moisture

In cold weather, trouble is often experienced with moisture, drawn from the powder and condensing on top of the electrode. This should be rubbed clean after every lift, to prevent dripping back on to the powder which might cause unsightly blemishes on the moulding. The trouble can be minimized by placing blotting paper over the top of the powder. If the powder is very wet (conditions may be excessively humid or storage conditions may be poor) it is sometimes beneficial to place blotting paper under the pellets.

Rate of Preheating

In general, the powder should be preheated for the shortest possible time, consistent with the degree of plasticity required. Shallow mouldings can be preheated to a far higher temperature than, say, a radio cabinet, which has a deep draw. This also depends on the speed of closure of the press, and the rapidity which the powder or preforms can be transferred from the R.F. oven to the mould. Mould designers should be aware of the advantages of transfer moulding in this respect, which offers a single pot to be filled (by a single preform for preference) in contrast to the operator having to fill a number of separate cavities by hand.

Loading Trays

Arising from the above, attention is drawn to the possibility of using loading trays for the rapid transfer of pellets to a multi-impression tool. Where possible the electrode is cut away at points where the power is not required, thus concentrating the R.F. over the pellets. It should be noticed that whenever possible the electrode should first fit the powder container or pellets (or large single preform) and not be excessively larger. Where the R.F. generator is called upon to attempt to heat up air, in the spaces between pellets or at the sides of powder boxes this throws an added strain on the equipment. It is much more economical and certainly better for the equipment to heat the plastic powder than to attempt to heat the shop!

One small story will serve to illustrate how it is possible, through ignorance of the technical make-up of a high-frequency unit, to impose such a load. It was observed that a press operator closed the lid of an R.F. oven without putting in his usual charge of powder. Thinking that his mind was temporarily working on a higher plane than the rather mundane job in hand, his attention was drawn to the omission. "That's all right," he said. "I'm going to dinner after this, and I don't want to preheat any more powder, but I do want to time the press by your clock on the preheater!"

Apart from the strain on the machine "that clock" was using about 3 kWs of electricity, so the moral must be that operators should receive a little more instruction, and that the management might provide a few less expensive timepieces.

Electrode Not Parallel

This is sometimes not easy to see if the electrodes are out of line from front to back. When the machine is tested at the factory, the electrodes are checked over the whole of their

surface by placing 1-in., 2-in. and 3-in.-thick plates on the lower electrode and then observing the run of the top electrode when lowered upon the plates. Such an accuracy might not be called for on large loads, but for loads of up to 1 in. thick certain checks should be carried out at fairly regular intervals. The tilt of the electrodes can usually be adjusted by means of the screws provided, but sometimes it may be necessary to shim up one side. If this is so, brass or copper must be used, and never steel. No steel should ever be introduced in a radio frequency oven. Contrary to the appearance, the lid springs and other working parts are not steel but usually plated phosphor-bronze. Referring back to the question of electrodes it will be seen that these must obviously be made of material which will not easily warp. Usually ¼-in.-thick aluminium or duralumin sheet is used, the edges being well radiused to increase electrical efficiency.

World's Industry Employs Plastics

INDUSTRIAL APPLICATIONS

V-belt pulleys are moulded to close tolerances under high pressure from "Compolene," a new fibrous material produced by W.C. Products Inc., 1748 Kerkeley Street, Santa Monica, Calif. ("Product Engineering," 1952/July/222.)

Electric insulation.—Experts review in short articles 50 years of development in electric insulation, dealing in particular with plastics compounds, vinyl and mica insulation. ("Journ. Electrochem. Soc.," 1952/July/147.)

A new aircraft wire produced by Surprenant Mfg. Co., Webster and Atlas Bank Building, Boston 8, Mass., has a polyvinyl chloride primary insulation and nylon jacket-extruded on the wire. ("Product Engineering," 1952/July/198.)

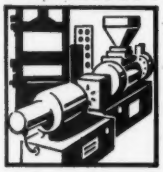
"Neoprene" wire and cable coverings.—H. E. Charles describes the development in the use of "Neoprene," characteristics and economics of the material are also dealt with. ("Wire and Wire Products," Vol. 27, 1952/351-354.)

Polytetrafluoroethylene as a wire and cable insulator is discussed in detail by B. E. Ely, who provides data on the properties of "Teflon" and methods of application. ("Wire and Wire Products," 1952/June/579.)

Teflon (p.t.f.e.) impellers have been successfully applied for chemical process pumps. ("Product Engineering," 1952/May/266.)

Moulded nylon gears.—F. R. Zumstein gives the design factors for this new type of gear. ("Machine Design," 1951/Oct./145.)

PROCESSES : MACHINERY



Machining thermosetting laminates.—Drilling, blanking, assembly procedures and other shop operations are dealt with by W. I. Beach. ("Machinery," N.Y., 1952/May/172.)

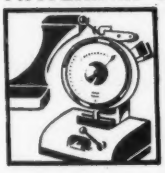
Plastics processing equipment is reviewed by B. R. Seymour and H. J. Fry. ("Chem. Engineering" (New York), 1952/Mar./136.)

Gates in injection moulds.—Based on the Poisenill law H. Gastrow develops data for the design of moulds. ("Kunststoffe," 1952/May/139.)

Marking of injection moulded parts.—A. Schmidt describes simple methods of marking polystyrene components. "Kunststoffe, 1952/May/37.)

Flame spraying of plastics.—New processes provide plastics protecting covers in layers applied to metal objects. ("Berichte Forschungsgesellschaft Blechverarbeitung," 1951/No. 2/51; "VDI-Zeits," 1952/Vol. 94/436.)

MATERIALS and TESTING



Properties of nylon.—R. Huenlich deals with the chemical and technical properties of nylon, based on English investigations. ("Rayon, Zellwolle" (Berlin), 1952/Vol. 30/122.)

New blowing agents for rubbers and plastics.—The role of sulfonyl hydrazide is described by B. A. Hunter and D. L. Schoene. (Ind. Eng. Chem. (Easton-Pa), 1952/Vol. 44 (1)/119-122.)

Plastics in synthetic rubbers are discussed by G. A. Bloch. (Legk. Promysl (Moscow), 1952/Vol. 12, No. 2/34.)

Vinyl fibres.—F. Grabe shows that the difficulties of dry spinning polyvinyl fibres could be overcome by using as solvent, carbonic disulphide mixed with chlorinated hydrocarbons, Ketones, acetic acid and salicylacid esters. He describes an apparatus for the continuous recovery of the solvents. ("Kunststoffe, Vol. 42, 1952/March/69.)

Flow properties.—This report describes work on the behaviour of polymeric materials subjected to sinusoidal loading. Based on the principles of absolute reaction rates as applied to viscosity, a method is developed of treating experimental data obtained from longitudinal vibration tests on fibres, for the evaluation of significant flow constants. Experimental optical methods for obtaining the necessary data are described. The temperature and humidity of the test fibre, Nylon 66 monofils, were controlled. —(Utah University, Tech. Report VIII (PB 105018). D.S.I.R. Tech. Inf. and Documents Unit Microfilm.)

Impact testing.—A new method of measuring the impact strength of polymeric materials is described. The extraneous energies measured by the standard Izod test, the most important of which is the energy required to toss the sample, are eliminated. Comparison of tests by the new method and the Izod shows that the new method ranks materials in the correct order as indicated by service performance. Impact strength as measured by this new method is shown to be independent of the mass of the broken sample, permitting tests over a wide range of velocities.—(Princeton University, Plastics Laboratory Technical Report 12C. (PB 104522.) D.S.I.R. Tech. Inf. and Documents Unit Microfilm.)

Elastomer compounds for high vacuum applications.—Commercially available gasket-type rubber seals for kinetic high-vacuum systems are not entirely satisfactory owing to the volatilization of plasticizer and pigment constituents in service. This report presents a study of the application of butyl, "Neoprene" and butadiene-acrylonitrile-type elastomers for high vacuum seals. All elastomer compounds were found adequate for maintaining vacuum in the range of 10^{-5} to 10^{-6} millimetre for a rapid pumping system. Rubber permeability is shown to be a governing factor in seal effectiveness.—(Naval Research Laboratory Report 3827 (U.S.). (PB 104729.) D.S.I.R. Tech. Inf. and Documents Unit Microfilm.)

MISCELLANEOUS USES

Piping.—After an 8 months sea test aboard a destroyer escort, the U.S. Navy plans to install plastics piping on several new minesweepers. ("Mechanical Engineering," 1952/Apr./322.)

Norwegian plastics.—A. Dobrowen gives a detailed survey of this country's developing industry. ("Tidsskrift for Kjemi, Bergwesen og Metallurgi," Vol. II, 1951/Oct./120.)

Swedish plastics industry is expanding but this causes raw materials problems. A survey is given on basic and raw materials available in Sweden, problem of rationing, possibilities of import and export. ("Chem. Trade Journal," 1951/Vol. 129/665.)

The development of the Dutch Plastics Industry has been reviewed by H. F. J. Frenkel ("Econ-stat Berichte" (Rotterdam), 1951/Vol. 36/901.)

Yugoslav Plastics Industry.—The plastics works "Jugovinil," specializing in polyvinyl chloride, are described. ("Commerc. Inform. Yugosl. Chamb. Comm." (Belgrade), 1951/Vol. 5/No. 1/23.)

Indian Plastics Industry.—An article deals with the development, market difficulties and necessary governmental measures. ("Journ. Indian Merch. Chamber" (Bombay), 1952/Vol. 46/No. 1/pp. 41-46.)

Literature references.—G. B. Thayer gives a selected list of references to plastics (117 items) for the mechanical engineer from July, 1950 to June, 1951. ("Mech. Engineering," 1952/Apr./309.)

LETTERS TO THE EDITOR

Correspondents are reminded that a stamped and addressed envelope should be enclosed in all cases where a personal answer is desired. It is understood that any letter received may be published at the discretion of the Editor.

Fluorescent Plastics

SIR,—We have had one or two inquiries of late regarding a fluorescent-sheet thermoplastic material, which ranges from 0.040 ins. thick upwards. This material to look at is rather like amber 300 "Perspex," but when turned sideways, to enable the light to catch it, then it gives off a red glow. With this in view, is it at all possible that you could supply us with the manufacturer's name and address?

GLENWOOD PRODUCTS.
Dunstable, Beds.

[EDITOR'S NOTE: The sheet may be of "Perspex" or of cellulose acetate, treated with one of the fluorescent dyes. Imperial Chemical Industries, Ltd., produce a speciality product, Polymon Brilliant Red B.S., for the purpose. Sources of fluorescent "acrylic" and acetate sheet supplied.]

Plastics in Housing

SIR,—In reply to your letter of September 5, we would say that there are no plastics materials in any of the houses which we are exporting.

You mention a plastics fly-screen, and we have been making some inquiries about this to compare its efficiency with what we are now using, and would be grateful if you could put us in touch with British firms who are making this material.

The only offer we have had so far has been from a firm of agents who are offering a Continental product, and we should much prefer to buy in England if at all possible. All the plumbing for the Canadian market has been designed in copper tube.

H. NEWSUM, SONS AND CO., LTD.
Lincoln. (Riley-Newsum Housing Department.)

[EDITOR'S NOTE: This letter has been received in answer to our questions put to the above company regarding the possible use of plastics in the Riley-Newsum House now being exported to Canada complete with plumbing, fly-screens, etc. The British fly-screen we referred to is that made by Fothergill and Harvey, Ltd., 37, Peter Street, Manchester, 2. Alternatively, information may be obtained from B.X. Plastics, Ltd., who produce the raw material from which the screen is woven.]

Hot Water Container

SIR.—We are interested in a moulding material for a hot water container to hold about 2 gallons of water. The temperature of the water frequently changes from 50 degrees F. to 180 degrees F. The container is always full of water, and during most of the 24-hour day the temperature is about 140 degrees F.

We have consulted various plastics firms who state that the best of the commercial plastics would not withstand the severe conditions under which the container would be subject beyond a limited period of time—not the 10 or more years that we are interested in.

We have now heard of glass fibre plastics, and it occurs to us that this material might be more suited to our needs. We should be pleased if you could put us in touch with some authority who could advise us as to the suitability, or otherwise, of glass fibre plastics for our particular requirements.

MAIN WATER HEATERS, LTD.
Gothic Works,
Thornton Road,
Croydon, Surrey.

P.V.C. Type

SIR,—We have a requirement for the stamping of various details on brass with silver nitrate solution. Rubber-faced type is normally used for this purpose. The rubber type faces are fairly rapidly attacked and crumbled away by the action of the silver nitrate.

Can you please say whether, to your knowledge, any type faced with p.v.c. or with some other plastic impervious to the action of silver nitrate is manufactured, and, if so, by whom. S.A.S.

[EDITOR'S NOTE: The destruction of the rubber is probably due both to the action of silver nitrate on the sulphur in the rubber and the well-known action of even traces of copper on rubber. P.v.c. would withstand the action of silver nitrate to a much greater extent, although there might conceivably be a slight action due to the formation of chlorides on the stabilizer content. This effect would not only be small, but different in character from the rubber reaction.]

Vacuum Chamber

SIR,—I am engaged on experimental work and have to use a vacuum chamber (18 ins. by 12 ins. by 9 ins. approx.) with a vacuum of 12-15 mm. mercury. I wish to observe what is happening inside the chamber and would be glad of help in the choice of a suitable plastic and the thickness required to withstand the external pressure. Can you also give me the name of a company who could make such a chamber for me? In the event of the experiment proving successful, there would be a demand for many of the chambers. The plastic would undergo no chemical or physical action.

Cornwall. E.J.C.

[EDITOR'S NOTE: We should imagine that few experiments of this type have been made, and we do not know of any specific data on the subject. The total pressure on the plastic (this would be "Perspex") may be taken to be 15 lb./sq. in. We suggest that a safe thickness would be of the order of ½ in. The name and address of a model maker is Partridge Models, Ltd., 24, John Islip Street, London, S.W.1.]

H.F. Welding Machine

SIR,—We are interested in a light welding machine which would enable us to weld p.v.c. sheeting used in floor covering. We would be obliged if you would inform us of the names of makers.

ETAB. FERMARCO.
Bd. Adolphe Max 144,
Brussels.

Polyesters, Co-polymers, Etc.

SIR,—We should be glad to know of British manufacturers who can offer:—

1. Polyester resins for laminations with glass fibre reinforcement.
2. Styrene co-polymer sheet.
3. Rigid p.v.c. sheet.

MESSRS. MERCA.
Piprensavägen 12,
Enskede,
Sweden.

Screw Plugs

SIR.—We wish to find manufacturers of a standard screw plug in moulded plastic, the plug to be approximately 1 in. diameter. The quantities required are not large, and we are therefore seeking a manufacturer who is already in possession of tools for producing this article for other goods.

MALLINSON & ECKERSLEY, LTD.
Brown Street,
Salford, 3.

Dispenser

SIR,—You have, from time to time, advertised in your periodical "Plastics" a "gun" suitable for dispensing of a given quantity of liquid or paste. As we are unable, at the present time, to locate this advert., we should be very much obliged if you could give us the name and address, so that we may contact the advertiser.

TODD BROS. (St. Helens and Widnes), LTD.
Widnes,
Lancashire.

"Materials and Methods"

SIR,—We would refer you to a small item re Mica Paper appearing under the heading "World's Industry Employs Plastics" on page 259 of your September issue of "Plastics."

We note that further detail with reference to this Mica Paper is contained in "Materials and Methods," 1952/June/174, and we should be pleased if you would advise from whom this publication may be obtained.

A. R. GIBSON.
Hollinwood,
Oldham.

New Productions

Traffic Indicator Arm

The "Omnibus" direction indicator unit recently introduced by Trico-Folberth, Ltd., is intended primarily for use in passenger-carrying coaches, buses and trolleybuses. Very sturdy construction and high dimensional accuracy determined the choice of urea formaldehyde material for moulding the indicator arm; the mouldings are produced by Moulded Products, Ltd. From the illustration it can be seen that the hinge of the arm consists of a heavy die-cast metal insert which must be located with great accuracy. This contrasts with the slender form, deep draw and thin section necessary to give adaquate translucency at the tip and makes the component a particularly difficult one to mould.

Telephone Amplifier

The instrument which we illustrate on this page may be connected to an ordinary telephone and amplifies all telephone conversations. Thus the use of a telephone hand set, i.e., earphone and speaker, is eliminated. Besides saving the use of hands, which is of particular importance when writing down messages or conversations, several people can listen to a conversation simultaneously. The "Televox," which is manufactured by Televox (London), Ltd., 5, Bourne Street, Sloane Square, London, S.W.1, is housed in a black plastics cabinet. The whole unit weighs 6 lb. The housing for the "Televox" is moulded in black phenolic material by British Artid Plastics, Ltd., Buckingham Avenue, Trading Estate, Slough, Bucks.

Draining Board

The plastics draining board has been talked of for many years, but few examples have been made and none of these have been on sale commercially in this country. A small draining board, measuring 20 ins. by 15 ins., has now been placed on the market by W. H. Cowles and Co., Ltd., 38, Blackfriars Road, London, S.E.1. The "Soclean" draining board is made from "Beetle" urea formaldehyde moulding material supplied by British Industrial Plastics, Ltd. Attachment to a sink is by means of a simple screw-up fitting. There are several great advantages in a moulded draining board; due to the design, there are no recesses to accumulate dirt, and there is no danger from chipped enamel or from soggy woodwork.

The draining board has been submitted to the Good Housekeeping Institute for approval, and has received the Institute's certification of quality.

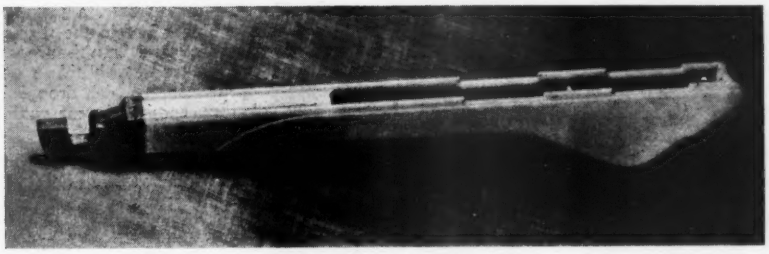
The plastics components—available in four colours: white, cream, eau de nil and pink—are moulded by Elco Plastics, Ltd., 19, Desborough Park Road, High Wycombe, Bucks. The export agents for W. H. Cowles and Co., Ltd., are Arthur Kreamer (Plywood and Veneers), Ltd., 8, Bloomsbury Square, London, W.C.1.

Food Mixer

Electrically operated food mixers for domestic use were introduced in the United States market some years ago, and both imported and British-produced models have also been gaining in popularity here. To make available some of the advantages of this rotary-type food mixer at a lower cost, Stone and Simmons, 73-75, Mortimer Street, London, W.1, have produced a hand-operated type. All the components of the mixer are injection moulded from clear and coloured polystyrene. The base consists of a transparent container with handle, pouring spout, and graduations marked on the side. The lid is pierced to take the handle, gear and the counter-rotating blades, which are all moulded from opaque polystyrene in pastel shades.

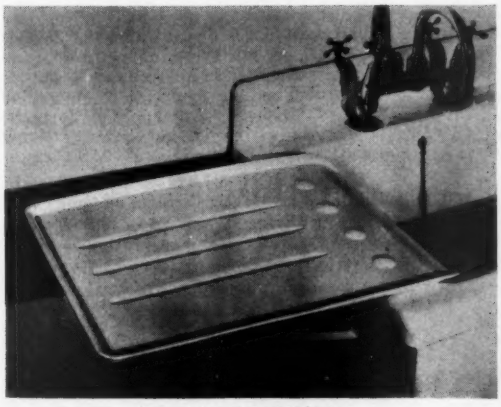
Laminated Plastics

These materials are now being used on H.M. ships. While the 9,000-ton cruiser H.M.S. "Swiftsure" has been refitting this year for service with the Home Fleet, the ship's officers decided to redesign the layout of the ward room ante room and to modernize its fittings. The original bar, which was of timber construction, has been re-covered, with scarlet softglow "Formica" cigarette proof grade being used for the bar top and buff "Linette" for the riser. Members of the ship's company carried out the installation.



Traffic indicator arm (urea).

Food mixer (polystyrene).

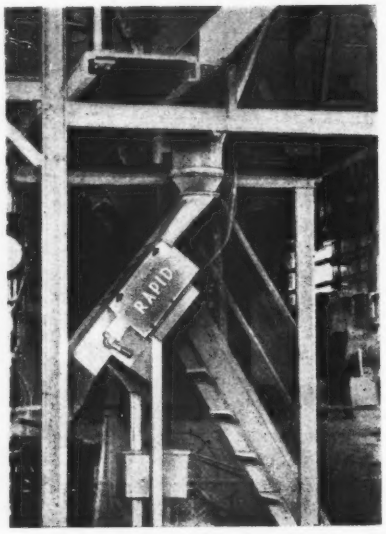


Draining board (urea).

Telephone amplifier (phenolic housing).

PRODUCTION NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes



MAGNETIC SEPARATION.—Two new publications of Rapid Magnetic Machines, Ltd., Lombard Street, Birmingham, 12, relate to electro - magnetic chute - type separators (No. 122) and permanent magnetic equipment (No. 134). Our photograph shows an installation for extracting fine iron from plastics powders. The apparatus is angularly inclined at 45 degrees and the material flows evenly over a series of stepped magnets of high intensity, where the prevalent iron is arrested and drawn into polarized cavities out of the line of flow. A collapsible bridge stops the flow and diverts the extracted iron on switching off the current or in the event of current failure.

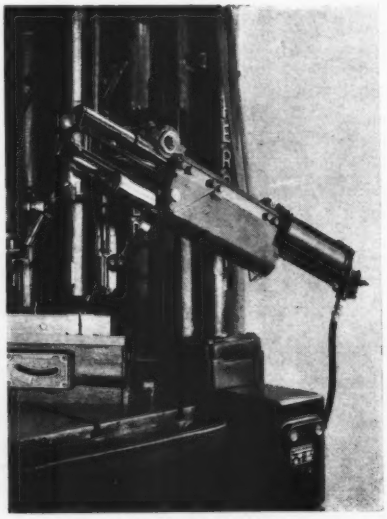
ELECTROTHERMAL RUBBER SHEETING.—A new method of applying heat in defined areas of any size has been developed and produced and is now being extensively marketed by Electrothermal Engineering, Ltd., Neville Road, London, E.7, under the name E.R.S. (Electrothermal Rubber Sheeting). On examination, it appears to be a flat sheet of black rubber, but it is electrically wired, at 150, 250 or 400 watts per sq. ft. for mains operation, to radiate heat at controlled temperatures up to 200 degrees C., sufficient for all applications of heat to flat, shaped or curved surfaces, where the required heat input does not exceed 400 watts per sq. ft. Success has been achieved in the furniture and other constructional industries for quick setting of synthetic resin glues, and in view of the fact that no elaborate jigs or multiple clamps are necessary for this application, multiple production units may be set up quite cheaply, thereby increasing output at minimum cost. Other applications for E.R.S. are suggested daily and E.R.S. is used for the heating of chemical apparatus, tanks, vessels, trays, pipes, etc.

MATERIALS HANDLING. — The British Electrical Development Association, 2, Savoy Hill, London, W.C.2, has issued a booklet entitled "Material Handling in Industry." Using the slogan "Every time a material is handled, something is added to its cost and nothing to its value," its purpose is to show how the cost can be reduced to a minimum. There are twelve excellent chapters dealing with: the application of mechanical handling equipment (which defines the simple rules), overhead runways and lifting equipment, cranes, conveyors, elevators, floor transport and storage, vibrating equipment, etc.

SAFE WORKING.—The National Joint Industrial Council has published a booklet for the Rubber Manufacturing Industry, 236, Royal Exchange, Manchester, entitled "Safe Working on Horizontal Two-Roll Mills."

ARTHUR SPIELMANN NACHF. of Frankfurt/Main inform us that they have developed a new method of sealing plastic containers. The apparatus works on the same principle as that used for tin containers with the exception that flanges are not employed. The sealing is carried out by welding.

TOOL ROOM EQUIPMENT.—The British Bellows air-hydraulic feed unit, which is now being made under licence by Benton and Stone, Ltd., Aston Brook Street, Birmingham, 6, can be readily attached to drilling and milling machines, as well as other mechanisms requiring a controlled feed. It comprises an air cylinder, providing the motive power to drive a rack and pinion, cushioned with a hydraulic check cylinder. Full adjustment is provided for quick approach and the speed of feed during the cutting period, with a press-button start and an automatic return. This unit has already had wide success in America. Apart from speeding-up production, it also lengthens the useful life of drills or other cutting tools, by as much as 400 per cent., by virtue of the controlled cutting speed. Our photograph shows the unit in use on a Herbert drilling machine.



Air-hydraulic feed unit (Benton and Stone, Ltd.).

PROLITE, LTD., Central House, Upper Woburn Place, W.C.1, inform us that "Prolite" tipped roller mills engaged in machining ebonite strip produce nearly 17 times as many components between grinds as compared with the cutters previously used. No machine adjustment for wear was necessary, although tight tolerances are held.

BONDED JOINTS IN AIRCRAFT.—The latest addition to Aero Research Technical Notes, Bulletin No. 114, relates to "Bonded Joints in the Construction of Metal Aircraft." It is a translation of an article by Ir. R. J. Schliekelmann, project engineer, N.V. Kon. Ned. Vliegtuigenfabriek Fokker, published in "De Ingenieur." The author stresses the point that the use of bonded joints in aircraft structures reduces production costs, and that metal-to-metal bonded joints possess greater shear strength and stability as well as longer fatigue life than do spot-welded or riveted joints. Test results on "Redux"-bonded panels and composite sparbooms produced by the Fokker Aircraft Co. are given. Copies are obtainable from the Technical Service Department, Aero Research, Ltd., Duxford, Cambridge.

CASTING RESINS.—Technical Bulletin No. 21 of Catalin, Ltd., Waltham Abbey, Essex, relates to "Cataform" casting resin, which was developed for the rapid production of many types of tools, jigs and fixtures, particularly where two plane curvature is involved. This acid-accelerated resin of the thermosetting phenolic type sets rapidly with only a very slight shrinkage, and is dimensionally stable. It is a useful medium in which to cast tracers for use in engraving and three-dimensional milling machines, and for die-sinking patterns.

SYNTHETIC GREASES.—A technical service bulletin, published by the Witco Chemical Co., 295, Madison Avenue, New York, 17, describes the characteristics and uses of lithium hydroxystearate, a metallic soap used as a gelling agent in the manufacture of synthetic and multi-purpose greases. Greases prepared with this soap have excellent shear stability, high dropping points, low volatility, good anti-wear qualities and water resistance.

DESIGN REVIEW.—The Council of Industrial Design's photographic index of good current British design (first presented at the South Bank Exhibition last year) is now housed at the Council's headquarters, Tilbury House, Petty France, London, S.W.1, and retailers and designers are cordially invited to make use of it. It contains illustrated and up-to-date information on many products in a wide range of durable consumer goods. Duplicate prints of many photographs in Design Review may be obtained from the Council's Photographic Library, which can also supply photographs of general design interest covering many industries.

KLEESTRON, LTD., West Halkin House, West Halkin Street, London, S.W.1, have just issued a brochure showing the wide colour range of goods made from their polystyrene moulding powders. Two pages of data on mechanical, thermal, optical, electrical, chemical and moulding properties are included.

BIRKBYS, LTD., have asked us to mention that the imperfections in the printing of their August advertisement were due to faults which developed in the block.

SYNTHETIC-RESIN BONDED PAPER TUBES.—The British Standards Institution has just published a standard setting out the minimum requirements for synthetic-resin bonded paper rectangular tubes for use on electrical power circuits up to 1,000 volts. The new standard, B.S. 1885, is an addition to the published series dealing with insulating material and, apart from the voltage limitation, is complementary to B.S. 1314 (1946), which covered circular tubes of similar material.

The new specification deals with two types of rectangular tube intended for electrical insulating purposes with direct-current and with alternating-current up to 100 cycles per second. The internal side dimensions of the tubes specified range from $\frac{1}{4}$ in. up to 6 ins. with wool thicknesses of from 1/32 in. to $\frac{1}{8}$ in. Electrical and mechanical properties are specified, together with the tolerances on dimensions. Methods of test, including the preparation and conditioning of specimens prior to test, are fully described in appendices.

Copies of this standard may be obtained from the British Standards Institution, Sales Branch, 24, Victoria Street, London, S.W.1, price 2s. 6d.

INDUSTRIAL ALCOHOL.—The Distillers Co., Ltd., has reduced their selling prices of industrial alcohol. This, the company state, is in anticipation of a fall in the world prices of molasses, and is only made possible at the present time by writing down large stocks of molasses and alcohol by a considerable sum out of reserves previously created for such a contingency. This step has been deemed necessary at this stage in order to assist users of Industrial Alcohol and its derivatives, whose trade, both home and export, has been adversely affected by the present high prices resulting from the abnormally high cost of molasses. The new prices for plain British spirit range from 3s. 5½d. per proof gallon for quantities over 300,000 gallons per year, to 5s. 3d. for quantities of 10 gallons.

INSTITUTION OF WORKS MANAGERS.—The annual National Conference celebrating this October the 21st birthday of the Institution, is one of the activities recorded in their programme booklet for 1952-53. Details are also given of winter meetings in the fifteen regional groups. Copies of the booklet may be obtained by non-members as well as members, from the General Secretary, Institution of Works Managers, 67-68, Chandos Place, London, W.C.2.

THE GAUGE AND TOOL MAKERS' ASSOCIATION has published a fifth edition of its Members' Handbook, which is available on application to the Association offices at Standbrook House, Old Bond Street, London, W.1.

The handbook gives a brief survey of the services and activities of the Association, a list of members with addresses and a classified buyers' guide to the products of the members.

The Association has also issued a second edition of a comprehensive brochure giving details of the Customs duties and taxes levied by the principal world markets upon the importation of tools and gauges, including decisions taken at the Torquay Conference on tariffs. The countries dealt with include those in Europe, the Middle East, Far East, Latin America, Africa, Australasia, India, Pakistan, Canada, and U.S.A.

PHILIPS AND NATIONAL PLASTICS.—It has been announced that Philips Electrical, Ltd., have entered into a manufacturing agreement with the National Plastics Group for the pressing of gramophone records. The National Plastics Group have a number of factories and pressing operations will commence at their Avenue Works, Walthamstow, early in 1953. This follows the previous announcement last December that Philips Electrical would be entering the gramophone record field.

PURCHASE TAX.—A Treasury Order ("The Purchase Tax (No. 4) Order, 1952") provides for exemptions and reductions in tax on a wide range of goods. Among the exempted goods are "Pot scourers, other than metal pot scourers." Metal scourers are already exempt, and the new relief applies to fully manufactured hardware pot scourers such as those made of hard nylon or other plastic filament.

Reduction of tax from 100 per cent. to 66⅔ per cent. affects goods such as trunks, bags, wallets, pouches, purses, suitcases made from leather hides or skins.

GERMAN PLASTICS EXHIBITION AND CONVENTION.—Under the heading "Kunststoffe 1952" the leading trade and technical organizations of the German Plastics Industry have organized a trade and technical exhibition stated to be the first full demonstration of the scope of Germany's post-war plastics industry. The trade exhibitors will include manufacturers of materials, machinery and finished products, whilst general educational displays will show the science of plastics and the domestic uses of plastics.

The technical conference to be held October 13-16, includes lectures on the chemistry, physics and technology of plastics. Among the lectures are "Principles of the Structure of Macromolecules," by Dr. O. Bayer; "Thermal Decomposition of Macromolecular Compounds," by Dr. H. Hopff; "A Contribution to the Hardening of Plastics," by Dr. R. Wegler; "Stabilization of p.v.c. in the U.S.A.," by G. P. Mack; "Relationship Between Macromolecules Structure and Mechanical Properties of Deformation," by Dr. A. V. Blom; "Viscous Behaviour of High Polymers and Polyelectrolytes," by Dr. A. Peterlin; "Plasticizing Macromolecules," by Dr. Würstlin; "Current Problems on Testing," by Dr. R. Nitsche; "Applications of Lightweight Materials," by P. Hoppe; and "Plastics for Food Packaging," by H. Klingelhoffer. Other lectures will deal with problems of standardization and economic problems affecting the German industry. Social events and tours are also being organized. The exhibition and convention will be held at Düsseldorf on October 11-19, 1952. Further details are obtainable from the Organisationsbüro of "Kunststoff-Tagung-1952," Am Hauptbahnhof IV, Frankfurt (Main).

NATIONAL PLASTICS, LTD.—Mr. Allen G. Clark, Chairman of The Plessey Co., Ltd., and Mr. W. H. Newton, M.A., F.C.A., Chairman of Serck Radiators, Ltd., and director of other companies, have been appointed additional directors of this company.

B.X. PLASTICS, LTD.—The Dundee factory of the company, which was engaged in the manufacture of p.v.c. sheet, polythene layflat tubing, cellulose acetate sheet, etc., is to be closed and the production of the company is to be concentrated at their Brantham, Essex, factory. About 400 workers will be affected. The Dundee factory was a post-war development of B.X. Plastics, Ltd., carried out in conformity with the Government's allocation of industry policy.

SOLVENT PRICES.—Price reductions have been announced by a number of companies manufacturing solvents and chemicals. The companies include British Industrial Solvents, Ltd., A. Boake Roberts and Co., Ltd., and Shell Chemicals, Ltd. The materials affected are acetic acid and derivatives including acetic anhydride, Butyl acetate, ethylacetate and isopropyl acetates; dibutyl phthalate, diethyl phthalate, acetaldehyde, methyl ethyl ketone, mesityl oxide.

RESINOID AND MICA PRODUCTS, LTD.—Mr. Milton Marshall has recently been appointed General Manager of Resinoid and Mica Products, Ltd., of Balsall Heath, Birmingham, one of the subsidiary companies of Southern Areas Electric Corporation, Ltd.

In 1936 Mr. Marshall was Works Manager of the Plastics Section of British National Electrics, Ltd. He later joined the De La Rue Group and was appointed Works Manager of Scottish Plastics, Ltd., in October, 1943, and transferred to De La Rue Plastics, Ltd. (now British Moulded Plastics, Ltd.) at Walthamstow in August, 1945. He was appointed Works Director of that company in August, 1947, and Joint Managing Director in April, 1949.

MR. A. T. BUSS has joined Creators, Ltd., of Weybridge, Surrey, as Works Manager. In this capacity, he will also be responsible for publicity and technical direction.

ROSEDALE ASSOCIATED MANUFACTURERS, LTD., AND R. C. MILLS, LTD., have moved their London offices to 11, Upper Grosvenor Street, London, W.1. Telephone: Grosvenor 7847-8-9.

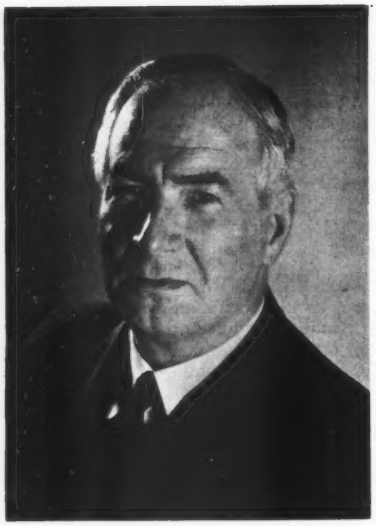
NEWTON HEATH TECHNICAL COLLEGE, MANCHESTER.—We have received details of courses to be held during the year 1952-53. Courses in plastics technology are now available leading to the Associateship Examinations of the Plastics Institute. Details may be obtained from the head of the Applied Science Department, Newton Heath Technical College, Newton Heath, Manchester, 10.

PLASTICS INDUSTRY GOLFING SOCIETY.—A meeting was held at the Berkshire Course, on September 9. Results:

British Plastics Trophy (Medal).—Winner: A. E. S. Matthews (10), 71. Runner-up: R. F. Johnson (8), 72.

I.C.I. Scratch Prize.—Winner: R. F. Johnson (8), 80 gross.

Rootes Prize (Stableford Bogey Foursomes).—Winners: C. Parkinson (7) and C. C. Last (16), 39½ points. Runners-up: F. T. Fletcher (10) and K. G. Butcher (12), 36½ points.



MR. GEORGE DRING.—On September 1, 1952, Mr. G. Dring, M.A., B.Sc., F.R.I.C., M.I.Chem.E., F.P.I., completed 25 years' service with Bakelite, Ltd., and at a private lunch, attended by senior executives of the company, was presented by the chairman and managing director, Mr. H. V. Potter, with a gold watch suitably engraved.

Mr. Dring's first experience in the plastics industry was in 1921, when, after taking an Honours Degree in Chemistry at Trinity College, Cambridge, he joined the Damard Lacquer Co. as research chemist. Two years later he went to Manchester with the Bradford Dyers' Association and returned to the plastics industry in 1927 following the amalgamation of the Damard Lacquer Co. and Mouldensite, Ltd., to form Bakelite, Ltd. He was works manager at Darley Dale until 1932, and when the new factory opened at Tyseley he moved to Birmingham in charge of the Development Department. He was made a director of the company in 1942, and still holds to-day the post of research and development director.

Mr. Dring has taken an active part, and has held many official posts in scientific and technical societies connected with the plastics industry. He is a vice-president of the Plastics Institute and chairman of the Plastics Industry Committee of the British Standards Institution.

BRITISH PLASTICS EXHIBITION AND CONVENTION.—The second British Plastics Exhibition and Convention will be held at Olympia, London, from June 3 to June 13, 1953, opening on the day following the Coronation.

The exhibition will occupy the whole of the National Hall, Olympia. As a result of the success of the first exhibition in 1951 over 82 per cent. of the space has already been applied for by 78 firms, including 28 suppliers of raw materials, 24 fabricators and moulders and 19 plant manufacturers, including all the best-known firms in the industry. Stand allocation will be made later.

To meet suggestions put forward by exhibitors at the first exhibition, several changes in layout are being made, the chief one being the construction of a wide staircase facing the main entrance of the National Hall, and giving direct access to the first floor. A gangway right round the first floor will keep it completely open to the hall and will overcome any feeling of isolation from the rest of the exhibition.

Additional lift service will also be provided and there will be ample sign-posting of stairways. With these improvements in mind, it has been decided by members of the appropriate sections of the British Plastics Federation that the entire first floor shall be reserved for the exhibits of manufacturers of plastics materials and laminates and suppliers of raw materials.

The ground floor will, as formerly, house the exhibits of the plant and equipment manufacturers and the moulders and fabricators.

The Convention will be on the same basis as in 1951, with discussions of papers, presented by leading authorities, on the most recent developments and rapidly developing materials in the industry.

Board of Trade Export Inquiry

The United Kingdom Trade Commissioner at Hong Kong reports that Messrs. Yuen Hing Hong and Co., Ltd., 520, Marina House, Fifth Floor, Queens Road, C, Hong Kong, wish to hear from U.K. firms who can supply:—

(a) machinery for making gift boxes from cellulose acetate sheeting.

(b) electric clock movements, for mounting in plastic cases, for sale in the markets served by Hong Kong.

(c) plastic insulated twin flex with transparent or coloured covering.

Interested manufacturers should communicate direct with Messrs. Yuen Hing Hong and Co., Ltd. The Hong Kong firm holds United Kingdom agencies for plastics, plastic toys, and hosiery; it has a branch company in Australia.

The Board of Trade, Commercial Relations and Export Department, Horse Guards Avenue, London, W.1, ask to be informed of any action taken. (Ref. CRE/27520/52.)

Forthcoming Meetings

Oct. 13.—" Some aspects of the Screw Extrusion of Thermoplastics," D. G. Owen and T. E. Atkinson. Plastics Institute, Midlands Section, Grand Hotel, Leicester, 6.30 p.m.

Oct. 13.—" Melamine in Review," Dr. R. F. Goldstein. Plastics Institute, London Section, Waldorf Hotel, Aldwych, London, W.C.2, 6.30 p.m.

Oct. 14.—Visit to " Shell " Refinery at Stanlow, Plastics Institute, North-Western Section.

Oct. 15.—"Melamine and Melamine Resins," Dr. R. F. Goldstein. Plastics Institute, Yorkshire Section, St. Mark's House, 186 Woodhouse Lane, Leeds, 2.

Oct. 15.—" Synthetic Fibres," Dr. R. J. W. Reynolds. Plastics Institute, Scottish Section.

Oct. 15.—" Photography in Industry." Miss M. D. Gauntlett. Plastics Institute, Southern Section, Polygon Hotel, Southampton, 7.30 p.m.

Oct. 17.—" Practical Do's and Don'ts in Tool Design," James Butler. Plastics Institute, Midlands Section, The James Watt Memorial Institute, Great Charles Street, Birmingham, 3, 6.30 p.m.

Oct. 21.—" Plastics in the Service of the G.P.O.," A. A. New and C. E. Richards. Society of Chemical Industry, Plastics and Polymer Group, Manson House, 26 Portland Place, London, W.1.

Oct. 21.—" Recent Advances in the Organic Chemistry of Sulphur," Dr. L. Bateman. Society of Chemical Industry, London and S.E. Counties Sections, Welwyn Garden City, " The Cherry Tree," 8 p.m.

Oct. 22.—" Plastics in Retrospect and Prospect," Dr. V. E. Yarsley. Plastics Institute, North-Eastern Section, Lecture Hall, The Mining Institute, Newcastle, 7 p.m.

Oct. 24.—Chairman's Address. Plastics Institute, North-Western Section, Engineers' Club, Albert Square, Manchester, 6.45 p.m.

Oct. 24.—Dance at the Botanical Gardens, Birmingham. Plastics Institute, Midlands Section.

Oct. 29.—Members' Problems night. " Problems Encountered in the Promotion of Export Sales," J. L. Daniels. "Problems of Press Design from the User's View-Point," N. G. McCullagh. " Problems Encountered in the Compilation of Specifications for Thermoplastics Raw Materials," R. H. Whitfield. Plastics Institute, Western Section, at T. H. and J. Daniels, Ltd., Stroud, 6.30 p.m.

Oct. 29.—" Statistical Quality Control in a Laboratory," B. J. A. Martin. (Dunlop Rubber Research Centre), Royal Statistical Society, Birmingham Group, Chamber of Commerce, 95 New Street, Birmingham, 2, 6.45 p.m.

Nov. 10.—Selling Plastics: " Producer to Fabricator," H. H. Lusty; " Selling to the Public," E. Atchelor; " The Certification Mark for Plastics," Dr. W. E. de B. Diamond. Plastics Institute, London Section, Waldorf Hotel, Aldwych, London, W.C.2, 6.30 p.m.

Nov. 12.—" Polytetrafluorethylene," Dr. W. C. Fergusson. Society of Chemical Industry, Plastics and Polymer Group, Mason Theatre, University of Birmingham, Edmund Street, Birmingham.

Nov. 12.—" Silicones," Member of Technical Staff, Midland Silicones, Ltd. Plastics Institute, Yorkshire Section, St. Mark's House, 186 Woodhouse Lane, Leeds, 2.

Nov. 12.—Symposium: Thermoplastics in South Wales. " Industrial Polymerization Processes," J. J. P. Staudinger. " Compounding," R. C. Gillham. " Moulding Techniques," Raymond Mather. Plastics Institute, South Wales, and Monmouthshire Section, Cardiff Technical College, 7 p.m.

Nov. 13.—Annual Luncheon. Plastics Institute, London Section, Criterion Restaurant, Piccadilly, W.1.

Stress Gremlins in Thermosetting Plastics

By H. M. QUACKENBOS, Jr.*

The residual stresses moulded into a part may be high. Tensile strengths are usually reported which are not valid for a part undergoing long-term strains. A proper evaluation of long-term test data is needed in selecting the proper material for a specific application. This article is reprinted from the April, 1952 issue of the Journal of the Society of Plastics Engineers, Athens, Ohio.

THE subject of stress and strain in rigid plastics is almost controversial. For example, you may meet two men who seem to know something about tensile strength. One says that tensile strength doesn't mean a thing. The other maintains that tensile strength is the most important test we can make. Often these two opinions are not as far apart as they appear to be. The trouble at the root of much of the controversy about stress is that people talk about slightly different things. In condemning tensile strength one man is thinking of its use in designing parts for a washing machine. While in approving tensile strength the other man is thinking of its value in quality control.

It seems to me important that we be quite clear as to the various angles of approach to this subject of stress.

Four Men

Number one is the tester, or the man who runs the test. Running the test is his living—not a rich living, but a living. He points with pride to the testing machine, talks about cross-head speed, and the like. He is often more concerned with the behaviour of material in the laboratory than with behaviour in the field in an actual moulded piece.

Number two is the physicist. Tensile strength is a sacred concept to him. He loves it for itself alone. Like the tester, he too is sometimes not much concerned with reality—that is with actual moulded pieces.

Next is the quality control man employed by the material producer. His job is to see that all batches of a certain material are as like as peas in a pod. You can appreciate that he is worried looking. He is interested in tensile strength because he uses it to tell him how similar his batches are. Now there is, of course, a connection between this activity and reality. The moulder naturally likes a uniform material. But that is only one of the moulder's problems. He has also to design the moulded piece so that it works. Here the quality controller can offer him no help. If the design is wrong and the moulding is breaking then it's no comfort to the moulder that all batches are alike and all mouldings will break.

The fourth man is the man who produces or designs the actual moulding. He is a composite of the moulder, the designer and the salesman of raw materials; let's call him the moulder in the future.

Now the moulder doesn't give a fig for tensile strength, in eight practical cases out of ten. In an ashtray, for example, you need a material that won't catch on fire when a cigarette is mashed on it and won't break into a thousand pieces when dropped on the floor. Tensile strength may enter into one case and the designer uses it to proportion his moulding to withstand the stresses involved or to choose between the various materials. In one more case out of ten the moulder thinks that tensile strength enters. Later he finds that a material with a low tensile strength performs better than a material with a high tensile strength.

Thus, there is a conflict in viewpoints between the laboratory man on one hand and the moulder on the other. By laboratory man I mean the tester, physicist or quality controller. The laboratory man tends to attach great importance to a test result. He tends to be unaware of the realities that the moulded piece must meet. He tends to put undue confidence in a few simple tests, in the tensile test, the flexural test, the Izod impact test and the 24-hour water absorption test.

The Moulder

The moulder, of course, is in touch with reality and generally, I believe, tends to discount the few simple tests I have just mentioned, although they are urged on him by the authorities in the laboratory. Using those tests alone the moulder cannot account for many of the failures of moulded parts—that is, Gremlins appear to enter.

Now this gulf between the laboratory man and the moulder has tended to disappear in the past few years. The moulder has been making larger mouldings and he has been screaming louder than before if the mouldings turn out unsatisfactory. These screams have reached the laboratory and the laboratory man has brought forward modifications of the old tests, and has developed new test information. For example, creep tests have been made in which the load is kept on the specimens for weeks, months and even years.

Laboratory Tests

Let me now discuss some laboratory tests—not as a laboratory man interested in the behaviour of a material in the laboratory but as a laboratory man hoping to present some laboratory tests from the realistic viewpoint of the moulder. And, further, with the hope of showing how some of the past mystery of failures can now be explained and, in the future, can be avoided.

Let us start with tensile loading and consider four simple examples in which tensile stresses enter.

In a spinning bucket, synthetic fibre is gathered into a hank and water is squeezed out through holes by centrifugal action, the bucket spinning at 7,000 r.p.m. The effect of spinning at 7,000 r.p.m. is to stress the wall of the bucket in tension. Next consider a metal insert. In cooling from the moulding temperature the plastic tends to shrink more than the metal. The result is that the plastic is under tension. Third, when a bottle cap is tightened tension is set up in the wall of the cap. Last, is a plastic container holding water. The water tends to swell or expand the fibres at the inner surface while the dry outside surface tends to remain as it is. Out of this conflict come stresses. The dry outside is under tension, the wet inside is under compression.

Insert Stress

Tension stresses enter in all these examples and the temptation is to analyse the examples in terms of tensile strength. Thus, if the bottle cap is breaking in service you would find another material with a higher tensile strength. This approach will get you into trouble because other factors enter.

In the insert for example, the stress is maintained for a long time, in fact for the life of the moulding. The spinning bucket may be spun for several hours, the hank removed and the bucket started again. Essentially, stress is maintained almost continuously. A bottle may remain capped for days, for weeks or even months. The container may hold water for a long period and again stresses are maintained for that time.

Remember now, that in ordinary tensile loading the load is applied in one or two minutes and the breaking stress for general purpose material is about 8,000 p.s.i. If the specimen is hung up under a stress of only half this—4,000 p.s.i.—it will fail in a few weeks or months. The stress that can be endured for years is smaller yet. This long-time stress is about one third of the tensile strength for phenolics; it is usually 1,500 to 2,500 p.s.i. With styrene polymers the long-time strength is only one-sixth to one-eighth of the short-time strength. That is, it varies between 1,000 and 1,500 p.s.i.

*Bakelite Co., Division of Union Carbide and Carbon.

Long Term Strength

From these figures for long-time strength you can see how far off you would be if you analysed the bottle cap, the spinning bucket, the container and the insert in terms of tensile strength rather than in terms of long-time strength. You would be in error not only in the safe stress that can be allowed but you would make a mistake in assessing the strength of various materials. The thermoplastics with a high tensile strength have a low long-time strength.

More is known about residual stresses in metal than in plastics. Kettering of General Motors was one of the pioneers. He found a way of strengthening and increasing the life of crank-shafts and other moving members. His methods seemed peculiar at the time. He shot-blasted or sand-blasted the metal member. Later is was proved that the strengthening was connected with the residual stresses induced by the treatment.

A structure under residual stresses is shown in Figure 1A. If the springs are released they come to their natural length, Figure 1B. Within the structure they're under considerable tension and the centre rod is, of course, under compression. A similar condition of residual stress might occur in a section of a steel crank-shaft, or in a plastic specimen.

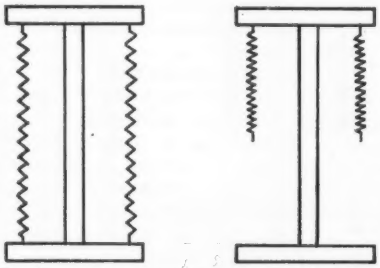


Fig. 1.—A. System under stress. B. No stress.

The model of Figure 1 shows how to reveal and measure residual stresses. A section is freed by slicing it off and the change in dimensions is noted. The model has only three fibres whereas a specimen of steel or plastic has a cross-section consisting of a multitude of fibres. The effect of slicing is, therefore, slightly different in practice from what it is in the model. For example, a brass rod that has been cut down the centre with a band saw shows a marked separation as in Figure 2. In the original rod there must have been a considerable stress holding together the two halves. The plastic bars so far examined have been small and the deformations are not large enough for a striking demonstration.

Fig. 2.—A brass rod sawed, shows residual strains.

The model also shows how residual stresses can strengthen or weaken. Suppose the model is loaded so that one of the springs is pulled in tension. The spring will snap or break prematurely because it is already under tension when the loading starts; some of its capacity to resist loads is already taken up. The residual stress thus weakens the structure in that area. On the other hand if the model is loaded so that the spring is compressed the residual stress has a strengthening effect. Part of the applied compression is taken up in off-setting the tension present before loading started.

In Kettering's crank-shaft the rain of shot compressed the surface and induced a residual stress. This was such as to strengthen the shaft against the surface tensile stresses that caused failure. Residual stresses in metals have been studied extensively and cases of weakening and strengthening have been observed. Further, something is known about controlling these stresses; if weakening they can often be removed by annealing and sometimes favourable or strengthening residual stresses can be induced.

Application to Plastics

We are just beginning with plastics. A few measurements have been made with phenolics. It is found that with a standard test bar residual stresses may be present to the extent of 3,000 p.s.i. and they can raise the flexural strength about 10 per cent. We know nothing yet of the occurrence of residual stress in moulding nor do we know how to control these residual stresses nor how they originate.

Residual stresses may be important in moulded objects. You should appreciate too that residual stresses introduce one more factor of uncertainty in translating laboratory results to the field. A laboratory test bar may not have the same strength as a moulded part containing high residual stresses.

The absorption of water by phenolic mouldings may have several effects that bring grief to the consumer. One, the material may expand and the expansion may destroy close tolerances and cause failure. For example, in a proposed water pump the impeller was to be of plastic and the casing of metal, Fig. 3. The material first suggested would have expanded .06 in. which is 2 per cent. The clearance between the casing and the impeller was only .02 in. and this material would have caused a slight reduction in pump efficiency. Two, an effect that springs from expansion comes into play when one side of a moulding is wet and the other is dry. For example, a lid on a vessel filled with water is exposed to this wet-dry condition. The fibres in contact with the water vapour tend to elongate, the dry fibres tend to remain the same length. The lid accommodates these

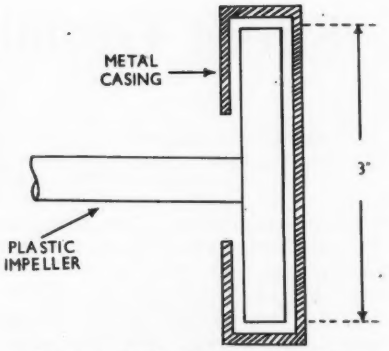


Fig. 3.—A plastic water-pump impeller.

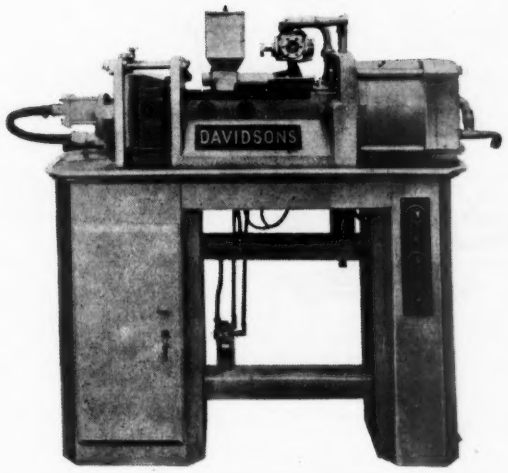
tendencies by warping, the wet side becoming convex. This happened in a washing-machine lid moulded from the wrong phenolic and the application was a failure. Three, another aspect of expansion in water arises with a vessel filled with water. Here the inside wet fibres tends to elongate; the outside dry fibres tend to remain the original length; the conflict produces stresses. These stresses may be measured with an electric gauge or by the springing apart of the cylinder on cutting after exposure to water.

In a rayon plant thread was being wound on a phenolic cylinder and was sprayed with dilute acid. The outside of the cylinder was wet; the inside dry. The stresses arising were such as to crack the cylinder after several months' use. A wiser choice of phenolics would have eliminated this trouble.

Perhaps it is unfair to talk of a wiser choice because at the time, several years ago, the facts for a wise decision did not exist. At that time a man faced by problems of water absorption might look for an answer in published test information. The only data he would find would be the weight gain of a disc immersed for 24 hours in cold water. This weight gain is .6 per cent. for a general purpose material and 1 per cent. for a fabric-filled material. Even if our man were Einstein himself he could scarcely deduce from these results anything about expansion, warping and stresses. He might have made the best of it, however, and reasoned that the fabric-filled material absorbed more water and therefore warping, expansion and stress would be more pronounced. These conclusions may be quite wrong. The 24-hour test reports the position at the end of the first lap in a race between a hare and a tortoise. Over longer times the tortoise goes ahead and the positions are reversed. The general purpose material takes up 8 per cent. of water to saturation and the fabric filled takes up 5 per cent.

It was found that essentially the whole sum of information about water absorption can be expressed fairly simply in a few numbers and a few graphs. With

(*Continued on page* 308.)



Machines for the Industry

Plasticor ¾-oz. Injection Moulding Machine

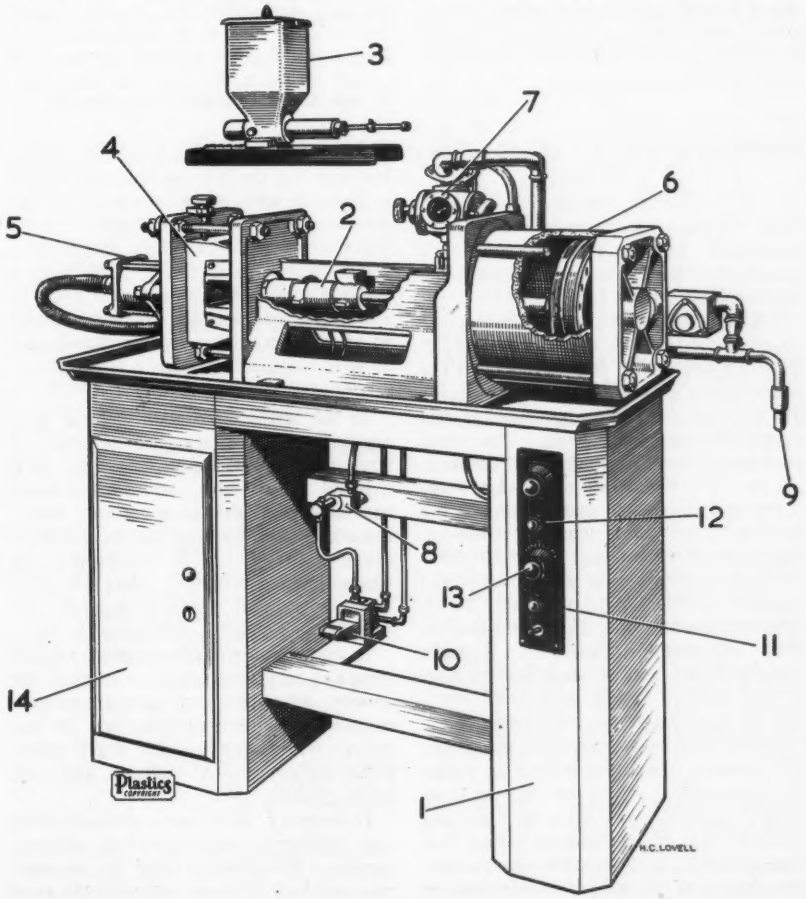
It has been said that the small injection moulding machine has its predetermined place in every moulding shop however large the machines in it. There is much truth in this statement, since it serves admirably for pilot runs and production in relatively low numbers. The small space it occupies, low initial cost and general simplicity of construction and working add to its appeal. The "Plasticor" ¾-ounce machine is made by Davidsons Engineers (M/c) Ltd., Manchester.

THE "Plasticor" Injection Moulding Machine produces most mouldings weighing up to ¾ oz. (20 gram.) cheaper and more efficiently than larger machines. Although the maximum weight of shot is ¾ oz. (acetate), a pre-plasticizing unit is available which will increase the capacity of the machine up to 1¼ oz. The floor space required is only 56 ins. by 20 ins. (1,422 mm. by 508 mm.) and its height is 48 ins. (1,219 mm.). As for the other abovementioned advantages; the maximum number of shots per minute is five (dependent on mould design); the electric heater consumption is extremely low, being only 700 watts; and the machine may be operated by unskilled labour.

This high-speed, semi-automatic machine is operated by compressed air at 60 to 100 lb./sq. in. (5 to 7 kg./sq. cm.) and it consumes 8 to 10 cu. ft. per minute. It is suitable for all thermoplastic materials and a specially designed injection chamber having a leak proof valve in the nozzle is available for use with nylon, if required. The machine is mounted on a cabinet type base (1), manufactured from steel of a substantial gauge, of attractive design and incorporating a useful lock-up compartment with shelves (14). All parts of the equipment are readily accessible for maintenance and it has been designed with an eye to the principles of time and motion study.

The injection chamber (2) is retractable and slides in four accurately machined guides inset in the body of the main casting. Four large, hardened steel, lugs are welded to the chamber to act as the bearing surfaces. These are precision ground in good alignment with the bore of the chamber to ensure a floating action. The injection chamber is made of hardened, nickel chrome, steel and its bore is honed to a mirror finish, and has a hard chrome deposit to prevent corrosion.

The injection chambers on these machines are all interchangeable and the time taken to change a chamber is only about two minutes. This speedy replacement time is a point of some importance when chamber replacements are frequently required to suit material or colour changes. A spare chamber, complete with its connections for the electric heater bands and with a ram fitted, may be supplied if the user feels it necessary. The ram is of hardened alloy steel and is



1. Machine base.
2. Injection chamber.
3. Hopper with metering device.
4. Mould locking unit.
5. Locking unit air cylinder.
6. Main cylinder.
7. Air gauge and regulator.
8. Main cylinder air regulator.
9. Main air line inlet.
10. Foot-operated valve.
11. Control panel.
12. Heater pilot light.
13. Thermostatic control.
14. Lock-up compartment.

Fig. 1.—The "Plasticor" ¾-oz. semi-automatic injection moulding machine.

hard chrome plated. It is hollowed out and, to prevent any overheating, exhaust air from the main air cylinder is blown through the ram to keep it cool. The torpedo is of stainless steel and is chromium plated. It has deep helical flutes which allow the available heat to be spread evenly to give a large heating area. The total pressure on the material is of the order of 3½ tons.

The hopper (3) is of large capacity as it will carry approximately 4 lb. (1.5 kg.) of material. This is an aluminium casting and a transparent cover is provided to enable its contents to be inspected visually. The operation of the hopper is such that it is self-metering in operation and the cylinder is automatically fed with the correct volume of material whatever the shot weight may be. Reference to Fig. 1 will show the metering gear at the base of the hopper.

The mould is held and locked by a self-locking vice unit (4) (Fig. 2). A small air cylinder (5) automatically releases the locked vice after every shot. The mould locking unit is an accurately machined, robust casting designed for rigidity at the highest stresses. Thermostatically controlled heaters are fitted into the unit. Five standard mould blocks are available for fitting to the self-locking vice. All are dimensioned 2⅜ by 2 ins. with third and major dimensions of 3 ins., 3½ ins., 4 ins., 4½ ins., and 5 ins. Standard die blocks in various sizes and materials are available. If required, special types of die locking unit may be supplied.

The main cylinder (6) which actuates the ram is a 10-in. double-acting cylinder having a 6-in. stroke and the self-locking vice unit is actuated by a small 3½-in. air cylinder.

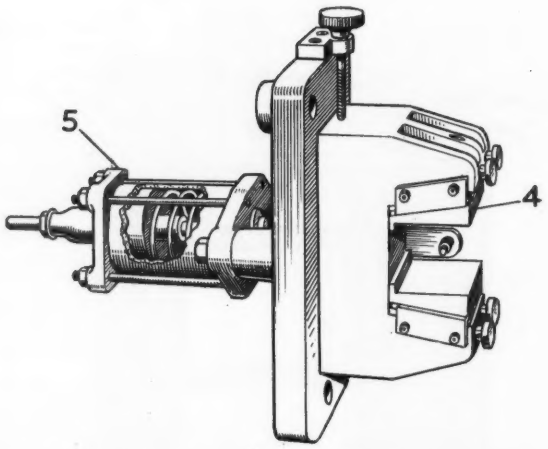


Fig. 2.—Details of the mould locking unit :
4. Self-locking vice unit.
5. Locking unit air cylinder.

Fitted in the air line is an air line lubricator, a pressure gauge and an air regulator (7). There is also a separate air line regulator (8) to the main cylinder which provides infinitely variable pressures and speeds to the ram. The outlet ports of the air cylinder are all linked up to an air silencer.

The main air line inlet (9) to the machine is ¾-in. British Standard pipe thread and, to ensure that the air cylinders operate with the greatest possible speed, the three air valves are ¾ in. in diameter. Each valve is relay operated and the whole system is controlled by a small foot-operated valve (10) in the base of the machine. This is a useful feature as it enables the operator to work whilst seated and yet have both hands entirely free; an important point when special classes of moulding work are being done. It allows the operator to load dies with inserts and manipulate, eject and inspect mouldings and carry out similar tasks all with the greatest of ease.

The " Plasticor " is thermostatically controlled and has two energy regulators (13) enabling the front and rear heating elements, on the injection chamber, to be controlled independently of one another. The thermostatic controls are located on a separate panel (11), to the right, in the base of the machine and two pilot lights (12) are also provided to indicate when the current is following and that one or both heaters are operating.

STRESS GREMLINS IN THERMOSETTING PLASTICS

(*Continued from page* 306)

these it is easy to calculate water gain, expansion, warping and stresses. You can do this for any time, temperature and thickness of sample.

I will just indicate how you can use these calculations in the three examples of water absorption just discussed. The water pump will be full of water during its life and evidently the impeller will eventually reach saturation. The initial clearance between impeller and casing is .02 in. The woodflour material absorbs 8 per cent. of water and expands 2 per cent. or .06 in. and it would be ruled out. High-impact fabric-filled material takes up 5 per cent. of water to saturation and expands 1.3 per cent. or about .04 in. This material would also be unsuitable. The asbestos heat-resistant phenolic absorbs 2 per cent. of water and expands .5 per cent. or .015 in. and could therefore be considered for this application.

In the washing-machine lid, the period of exposure is a little difficult to judge. At the worst it might be two or three days if the housewife were lazy and did not take care of the machine before that time elapsed. It is possible to calculate the degree of warping for this time of exposure for several materials. A suitable phenolic for the job can then be chosen.

This is one place where thickness counts. The thicker the plate or lid the less the warping. Similarly, thin lumber warps worse than thick lumber, in a given atmospheric condition. Thus, if you expect bad warping you may be able to offset it by using a thicker plate or lid.

Wet-Dry Cylinder

In the wet-dry cylinder there is good agreement between the predicted curve of stress/time using the principle we have evolved and the stresses actually measured. With a medium impact material the stress soon reaches a level of about 5,000 p.s.i. If maintained long enough this stress will cause cracking. With a general purpose material the stresses may reach a still higher level.

In fact, for a wet-dry exposure of long duration where stresses are caused, we cannot recommend a general purpose material. The only materials we can suggest for evaluation are the mineral-filled phenolics (heat resistant and electrical grades).

Laboratory tests have different uses and different meanings for different people. The physicist and the moulder may not look at these tests with the same eyes. I believe that many mysterious failures and disappointments have come about because the moulder got poor advice. His adviser spoke from the laboratory viewpoint rather than the practical viewpoint and, moreover, had not enough information to cover the numerous complications of moulding reality. Now more information exists and some of this was covered in discussing long-time loading, residual stress and water absorption. The moulder can use this new information with confidence. He can use it with the hope of avoiding in the future those mistakes he made in the past.

FORTY-SIX MILES OF CABLE IN NEW AIRCRAFT

FOR installation in the Saunders-Roe " Princess " flying boat, recently launched by Saunders-Roe, Ltd., at Cowes, the Pirelli-General Cable Works, Ltd., Southampton, has supplied some 46 miles of special cables, largely of the V.R. and Pren types. Pren cables, developed by cable manufacturers in association with the Royal Aircraft Establishment, Farnborough, are suitable for service up to 250 volts R.M.S. 400 cycles. The name " Pren " is derived from polychloroprene, the synthetic rubber used in the insulating compounds employed in the cable construction.

PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office, with the permission of the Controller of H.M. Stationery Office. The country of origin for Convention Applications is shown in parentheses. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 2s. 8d. each (including postage).

B.P. 669,038. Process and apparatus for the production of rods or tubing from glass, plastics or like substances. W. Schuller.

To prevent bending, rods are drawn from a revolving pot in vertical direction. This requires great height of plant (tower). By diverting the vertical rod after covering a short distance into horizontal direction under continued tractive force and cutting into length in this position, the disadvantage is overcome.

B.P. 669,049. Plasticizing synthetic substances. W. H. A. Thiemann. To: Donau Chemie, A.G.

Synthetic resins with high halogen content (e.g. polyvinyl chloride) are plasticized by incorporating compounds such as bis-(chloronaphthyl)-methane or 1.1.-bis (chlorophenylethane or 1.1.-bis-(trichlorophenyl)-ethane or 1.1-bis-(chloronaphthyl)-propane.

B.P. 669,165. Partially transparent fountain pen stems. T. Kovacs (Conv. Germany).

A tube of transparent material is injection moulded or cast into or around a preformed translucent (partially transparent, apertured) sleeve extending only along the rear end of the tube.

B.P. 669,290. Apparatus for opening moulds. E. Holroyd. To: Dunlop Rubber Co., Ltd.

The upper mould part is held by an electromagnet in a frame with upper and lower support plates. Double acting means mechanically move the support plates for separating the mould parts.

B.P. 669,299. Screens. R. L. Wetmore, Cockade, Ltd.

Each screen element of "Holoplast" is pivotally supported by the pintles of adjacent posts for easy detachment.

B.P. 669,327. Containers for liquid. H. E. Lee, R. J. Graham.

Special shape of the neck part with special stopper act as drop catcher with return of the drop to the bottle.

B.P. 669,346. Polymerization of vinyl halides. A. W. Barnes, I.C.I. Ltd.

The process is carried out under anhydrous conditions in the presence of certain monomeric material.

B.P. 669,452. Methods of production of polymers and copolymers of acenaphthylene. To: Brit. Thomson-Houston Co., Ltd. (U.S.A.)

B.P. 669,460. Plastic product and process of manufacturing same. A. H. Stevens. Comm. from: Research Corp.

Plastic materials and moulded artificial resins made from blood albumin tend to be brittle. Fibrinogen, a protein made up of long rod-shaped molecules was found admirably suited for a novel plastic product for use in surgery and medicine. The process includes the treating of blood plasma for the precipitation of fibrinogen.

B.P. 669,487. Production of polymers of 3-vinylpyrene. To: Brit. Thomson-Houston Co., Ltd. (U.S.A.)

The homopolymers have the physical properties of polystyrene but have higher softening points. Copolymers with certain other vinyl compounds are thermoplastic, can be injection- or compression-moulded, cast into films, oriented and fused.

B.P. 669,509. Perspective drawing instrument. M. G. F. Ventris.

B.P. 669,558. Suction cleaners. Brit. Thomson-Houston Co., Ltd., T. F. Stent.

The casing is formed of a base moulding and a cover moulding. The two mouldings include integral locating members for fan and motor. The parts may be die castings or synthetic resin mouldings.

B.P. 669,587. Sliding clasp fastener. V. Weber. To: Aero Zipp Fasteners Ltd.

An automatically locking slider has an elongated cap attached to one of the shields. A leaf spring forms the end of the cap and bears against a part of the slider body.

B.P. 669,626. Windows for pressurized chambers. Saunders-Roe Ltd. Sir Arthur Gouge.

A grid conforming with the curvature of the cabin walls takes the structural loads and serves as external support for a "Perspex" panel.

B.P. 669,649. Hollow hosiery display forms. Brit. United Shoe Machinery Co., Ltd. B. P. Cooper, J. N. Henshaw.

The form is made of a tube of e.g. cellulose acetate introduced into a hollow mould, softened by heat and then expanded by fluid pressure. A trepanning operation (by power driven saw) is used for trimming to remove sharp corners.

B.P. 669,720. Process for dyeing moulded articles having a basis of an organic derivative of cellulose. To: Celanese Corp. of America. (U.S.A.).

The articles (buttons) are subjected to an aqueous dispersion of a dye for the cellulose derivative containing a soap and a water-soluble mono-alkyl ether of ethylene glycol or of diethylene glycol.

B.P. 669,738. Thermoplastics. R. H. Sturm. To: Cosmocord Plastics Ltd.

To obtain coated or printed (decorated) sheets, or composite sheets with paper, textiles or metal, foil formed of a polymerized ester of an acrylic and/or methacrylic acid, a solution of a partly polymerized ester of the same kind is applied, the solvent removed, and then the body (sheet) subjected to heat and pressure.

B.P. 669,739. Fabric decorating compositions. S. Lee, A. Booth. To: Interchemical Corp. (U.S.A.)

The lacquer phase comprises a colloidal dispersion of solid polyethylene resin in a polyisobutylene solution.

B.P. 669,775. Heat-sealing of bags. Mechanical Designers Ltd. R. F. Cordey.

The bags of regenerated cellulose are heat sealed in upright position without manual handling between a pair of heated wheels.

B.P. 669,778. Aqueous dispersions of polymeric materials. B. S. Dyer, I.C.I. Ltd.

Stable aqueous polyvinyl chloride dispersions are obtained by incorporating a water soluble salt of a polybenzyl sulphonic acid. On conversion to solid products (films, sheets) colour stability during processing is improved.

B.P. 669,788. Trays for domestic and other purposes. J. G. Attewell, B. Attewell and Sons Ltd.

A railing of glass or transparent plastic material is caused to glow by the light of a concealed lamp.

B.P. 669,796. Freezing tray. F. W. Sampson. To: General Motors Corp. (U.S.A.)

A grid (metal or plastic) is used with flexible cross walls fixed to the longitudinal main wall at its lower portion only to facilitate loosening of ice blocks.

B.P. 669,819. Injection moulding processes. C. C. Gravesen. (Denmark.)

The moulding material is fed to the mould cavity through a feed channel located in the core to be exposed when the parts of the mould assembly are separated. Thus a scar is left internally in the moulding and the external faces are not affected when the sprue is (automatically) cut off.

B.P. 669,828. Book binding. W. W. Triggs. Comm. from: Marador Corp.

Prefabricated covers of plastic have an integrally formed separate strip of flexible material bonded thereto along one edge. They are to be stitched to the gathered signatures of a book filler and form a hinge for the cover.

B.P. 669,860. Closure of paper and like bags. P. Ohlef.

A closure lamina has a rim with a strip of thermoplastic synthetic foil and is bent up at an angle. The bag is sealed at the rims.

B.P. 669,864. Date indicators for calendars. A. E. C. Norris.

A frame of metal or (coloured) plastic is provided with downwardly directed spikes (pins) to be hooked on the calendar sheet around the date to be identified.

B.P. 669,897. Illuminating devices for signs or the like. B. Gowshall.

A light-emitting opening extends along the full length of the bottom of the lamp casing and halfway up the end walls. The opening may be closed by a sheet of "Perspex," coated so as to render it opaque except where the light is to pass on to the sign.

B.P. 669,907. Manufacture of moisture-proof sheet wrapping materials. W. Berry, C. R. Oswin, R. A. Rose. To: Brit. Cellophane, Ltd.

An aqueous emulsion of vinylidene chloride polymer is applied to a base sheet of regenerated cellulose in a layer of such thinness that the water of the emulsion is wholly absorbed. The layer is then stripped from the base sheet, dried and consolidated by heat.

B.P. 669,918. Lamp shades. A. Page.

Flexible shade panels (parchment, plastics) have holes on top. A wire frame is provided with hooks which engage in the holes and retain the panels in a desired shape.

B.P. 669,942. Manufacture of wrapping material. K. E. S. Wallenberg.

A wrapping for protecting bread and other foodstuffs from becoming mouldy is impregnated with paraffin wax containing paranitrobenzoic acid and/or esters thereof (ethyl paranitrobenzoate). The wrapping may be paper, metal foil, plastic or the like.

B.P. 669,993. Lighting fittings. Benjamin Electric, Ltd. Comm. from: Benjamin Electric Mfg. Co.

A plurality of lighting units is mounted overhead a louvred false ceiling composed

of a series of parallel vertical translucent strips crossed (at right angles) by another series of similar strips. These strips are made of " Vinylite " formed in a roughened condition by an extrusion process.

B.P. 670,039. Moulding apparatus with leakage-preventing means. W. W. Triggs. Comm. from: Fellows Gear Shaper Co.

An automatic resilient diaphragm valve associated with heating chamber and delivery outlet is urged in one direction by the pressure of the material in the chamber to allow flow of the material and is automatically moved in the opposite direction on completion of the injection operation, so as to prevent leakage of the plastic when the moulded article is removed.

B.P. 670,052. Screw closure caps for tubes, bottles and the like. L. Gruber.

The outer part of the two-part cap consists of a resilient vinyl material (" Igelit ").

B.P. 670,069. Method of making piano action flanges. L. M. Martin. To: Winter Co. Inc.

The flanges are plastic moulded, singly or in groups, enclosing a sheathed core wire which is afterwards removed.

B.P. 670,074. Moulding machine for plastic articles. C. E. Gilbert, Gilbert Mfg. Co.

The mechanism includes a die member with a cavity for shaping the exterior of the article (insulating plug bodies for electrical connectors), a force member for shaping the interior, and a movable hollow sleeve in which the force member slides. The moulding material is fed into the sleeve while the force member is retracted. Both are then moved together towards the die while applying heat and pressure.

B.P. 670,075. Bobbins, pirns and tubes for holding yarn and thread. H. Hodgkinson, J. Sutcliffe.

Barrel, plug and collar are integral and formed from one piece of paper or from resinated or plasticized fabric, or from thermoplastic resin in sheet form or extruded in tube form.

B.P. 670,078. Packaging articles. To: Wingfoot Corp.

The articles are packed in a stretched film which shrinks when heated. The film is stretched, preferably in two perpendicular directions, then held against shrinkage while heat is used to heat-seal plies of the film together before the final shrinkage operation. Rubber hydrochloride film appears preferable because it retains its heat-shrinking ability, even after intervening cooling periods.

B.P. 670,107. Means for marking lines on roads. H. W. Dakin-Potts, F. J. Goch, W. Quilter. To: I.C.I., Ltd.

The material is an elongated rectangular resilient strip of plasticized polyvinyl chloride containing a filler and a pigment. One or more longitudinal rows of light-reflecting beads of hard glass are embedded in the strip.

B.P. 670,108. Production of moisture-proof sheet wrapping material. W. Berry, C. R. Oswin, E. G. Sanderson. To: Brit. Cellophane, Ltd.

A partially condensed urea-formaldehyde resin is applied to a base film of regenerated cellulose. A sulphite or a hydrosulphite serves as condensing agent for the resin, yielding sulphur dioxide under the conditions of application of the moisture-proofing coating.

B.P. 670,113. Multiple-pin, two-part electric couplings. H. J. Dixon, D. E. G. Chapman, A. G. Gauterin, Brit. Insulated Callender's Cables, Ltd.

A moulded body of inelastic insulating material (polyethylene) has a multiplicity of moulded-in socket contacts, the other coupling part moulded-in pin contacts. The unembedded portion of each pin is equal to, or greater than, twice the axial length of the socket-engaging part of the unembedded portion.

B.P. 670,125. Toy bells. F. W. Holmes-Green, R. A. Clements.

B.P. 670,137. Spectacles. W. Jameson, Walter Jameson, Ltd.

The rim lugs and mounting fitments are readily releasable for repair. The temple movement stresses are distributed over areas in mutually perpendicular planes.

B.P. 670,141. Toys. J. P. Gowland.

The toy is an articulated (plastic) body, e.g., a vehicle with driver or passengers, and animal, etc.

B.P. 670,147. Shuttlecock. W. C. Carlton, D. R. Milne. To: Carlton Tyre Saving Co., Ltd.

A suitable plastic material (celluloid, styrene, ethylene compounds) is recommended.

B.P. 670,164. Telephone receivers. J. Wolff. To: Fortiphone, Ltd.

A miniature receiver consists of two instantly detachable units. For the case unit, a moulded plastic is used.

B.P. 670,197. Polymerization of vinyl chloride. R. J. Wolf. To: B. F. Goodrich Co.

A water-soluble phenol-aldehyde resin proved an exceedingly efficient emulsifying agent. The resins are clear, transparent, heat and light resistant.

B.P. 670,233. Laminated thermoplastic sheet material and products made therefrom. To: Nat. Blank Book Co.

Two sheets of decorative plastic material enclose a stiffening sheet. The projecting margins of the two plastic sheets are welded together permitting slippage of the stiffening sheet inside within small limits.

B.P. 670,244. Laminated articles and methods of making the same. D. H. Powers. To: Monsanto Chemical Co.

Laminæ of cellulosic fabrics (papers, mixtures) are treated with colloidal silica and bonded by contact pressure type resin.

B.P. 670,277. Method of making binder cases for bound or loose-leaf books. To: Nat. Blank Book Co.

A product very near in quality to fine leather binding is obtained by covering a sheet of stiffening material creased along hinge lines for cover and back panel portions with a limp sheet of thermoplastic material and heat sealing the sheets together. The laminations are left loose in the cover areas between hinge lines and peripheral margins.

B.P. 670,313. Manufacture of plastic fluid containers, especially ampoules. F. Meyer.

The container is an extruded plastic tube slit longitudinally for feeding fluid into it, resealed and divided into individual compartments by transverse sealing seams. Extruding, slitting, filling form a continuous process.

B.P. 670,314. Ampoules for medical purposes. F. Meyer.

The ampoule is made of thin flexible synthetic thermoplastic material capable of being pierced by a hypodermic syringe, the walls being so thin that they collapse as the contents are withdrawn, preventing a formation of vacuum within.

B.P. 670,489. Toys. O. Graham.

An animal figure (dog) is moulded from a suitable plastic material with a two-part pivotable head hinged together. One part carries a magnet inside so that the head turns and the mouth opens when a second magnet, e.g., a bone on a string, is near the head.

B.P. 670,544. Supporting device for tablets or bars of soap. S. Z. Ogus.

A dished member of plastic material has a roughened underside (pumice stone or like face). Upwardly projecting spikes hold the soap.

B.P. 670,575. Viewing screens for lenses for optical projection systems. H. E. Holman. To: Electric and Musical Industries, Ltd.

Rigid sections arranged edge to edge are each formed with light refracting grooves. The sections are preferably moulded from transparent or translucent organic plastic material (polymethyl methacrylate).

B.P. 670,605. Optical lenses. H. E. Holman. To: Electric and Musical Industries, Ltd.

The lenses are composed of sections with lenticular formations of different curvatures (Fresnel type lenses) for television receivers. The sections may be moulded from polymethyl methacrylate.

B.P. 670,639. Manufacture of moulded articles of rubber and other curable plastic materials. St. Helens Cable and Rubber Co., Ltd., P. W. Clephan, A. J. Ensor.

A body of unvulcanized rubber compound is pressed round a rigid pattern within a hollow metal cylinder and vulcanized. The mould thus formed is opened and then used in the same rigid enclosure to manufacture the article, shaping it under pressure and curving it while maintaining the pressure.

B.P. 670,650. Pouring devices for liquids. G. H. Edwards. To: Lever Brothers and Unilever, Ltd.

B.P. 670,707. Method of and apparatus for the manufacture of flattened tubing from thermoplastic materials. To: British Xylonite Co., Ltd.

The material (polyethylene) is continuously extruded through an annular die. Fluid pressure is then introduced into the extruded tubing which, while passing through a passageway of certain cross section, is blown into contact with the walls of the passageway and thus shaped with longitudinal tucks and pleats to be collapsed afterwards. It serves for packaging.

B.P. 670,708. Manufacture of tubing from thermoplastic materials by extrusion. J. Bailey. To: British Xylonite Co., Ltd.

The extruded and by internal fluid pressure expanded tube of polyethylene is engaged outside by restraining sizing means (rolls) arranged around the tube in spaced intervals.

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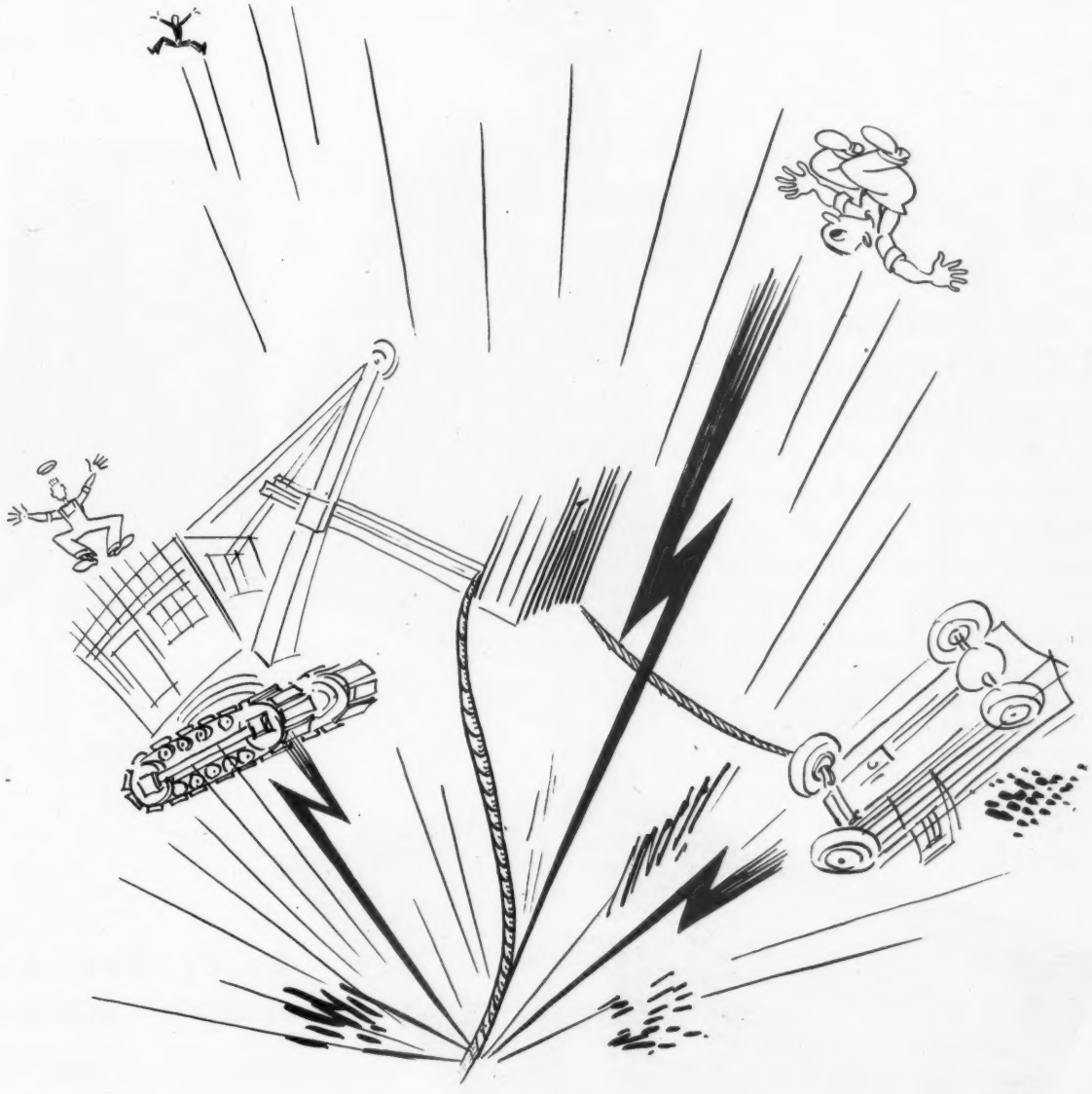

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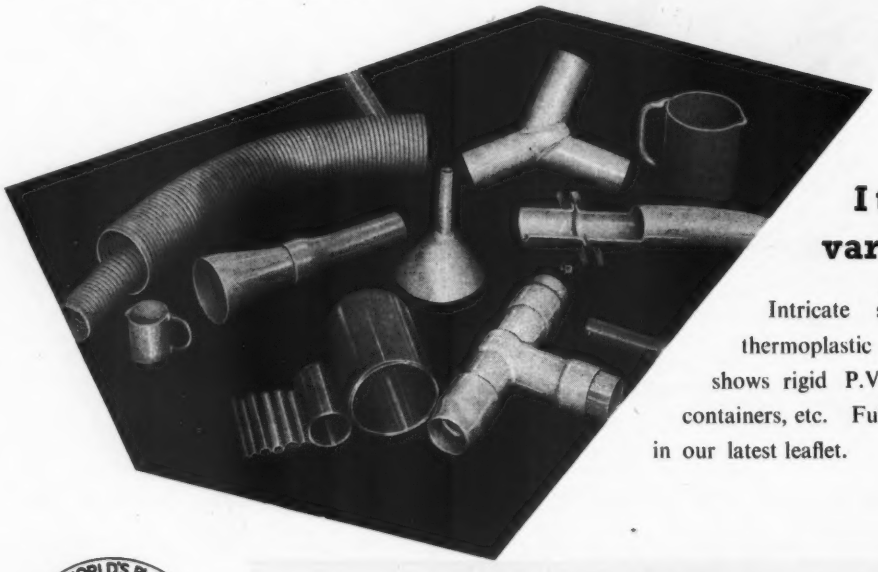

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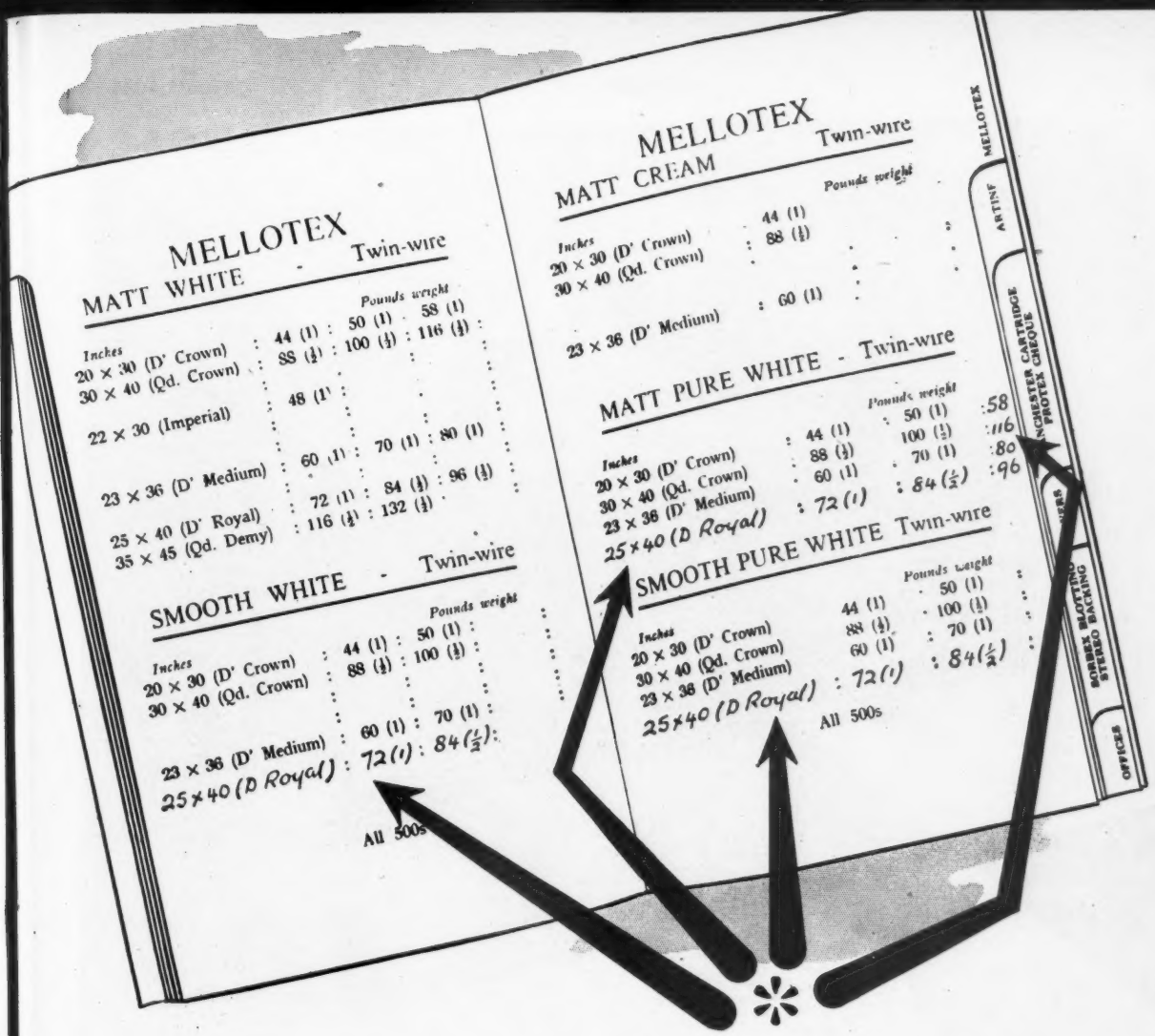
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MATT WHITE - Twin-wire
Pounds weight
Inches
20 × 30 (D' Crown) : 44 (1) : 50 (1) : 58 (1)
30 × 40 (Qd. Crown) : 88 (½) : 100 (½) : 116 (½)
22 × 30 (Imperial) : 48 (1)
23 × 36 (D' Medium) : 60 (1) : 70 (1) : 80 (1)
25 × 40 (D' Royal) : 72 (1) : 84 (½) : 96 (½)
35 × 45 (Qd. Demy) : 116 (½) : 132 (½)
SMOOTH WHITE - Twin-wire
Pounds weight
Inches
20 × 30 (D' Crown) : 44 (1) : 50 (1)
30 × 40 (Qd. Crown) : 88 (½) : 100 (½)
23 × 36 (D' Medium) : 60 (1) : 70 (1)
25×40 (D Royal) : 72 (1) : 84 (½)
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MATT CREAM Twin-wire
Pounds weight
Inches
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30 × 40 (Qd. Crown) : 88 (½)
23 × 36 (D' Medium) : 60 (1)
MATT PURE WHITE - Twin-wire
Pounds weight
Inches
20 × 30 (D' Crown) : 44 (1) : 50 (1) : 58
30 × 40 (Qd. Crown) : 88 (½) : 100 (½) : 116
23 × 36 (D' Medium) : 60 (1) : 70 (1) : 80
25×40 (D Royal) : 72 (1) : 84 (½) : 96
SMOOTH PURE WHITE Twin-wire
Pounds weight
Inches
20 × 30 (D' Crown) : 44 (1) : 50 (1)
30 × 40 (Qd. Crown) : 88 (½) : 100 (½)
23 × 36 (D' Medium) : 60 (1) : 70 (1)
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Designer's Diary N.º 8

Reprints of these announcements will be gladly supplied on request.

The Product. In the belief that moulded draining boards seldom meet full requirements certain improvements have been incorporated in this design.
These comprise a built-in compartment for neatly containing the paraphernalia associated with washing-up; deep sides, to enclose the tableware safely; and a pattern of raised studs against which to stack washed plates.

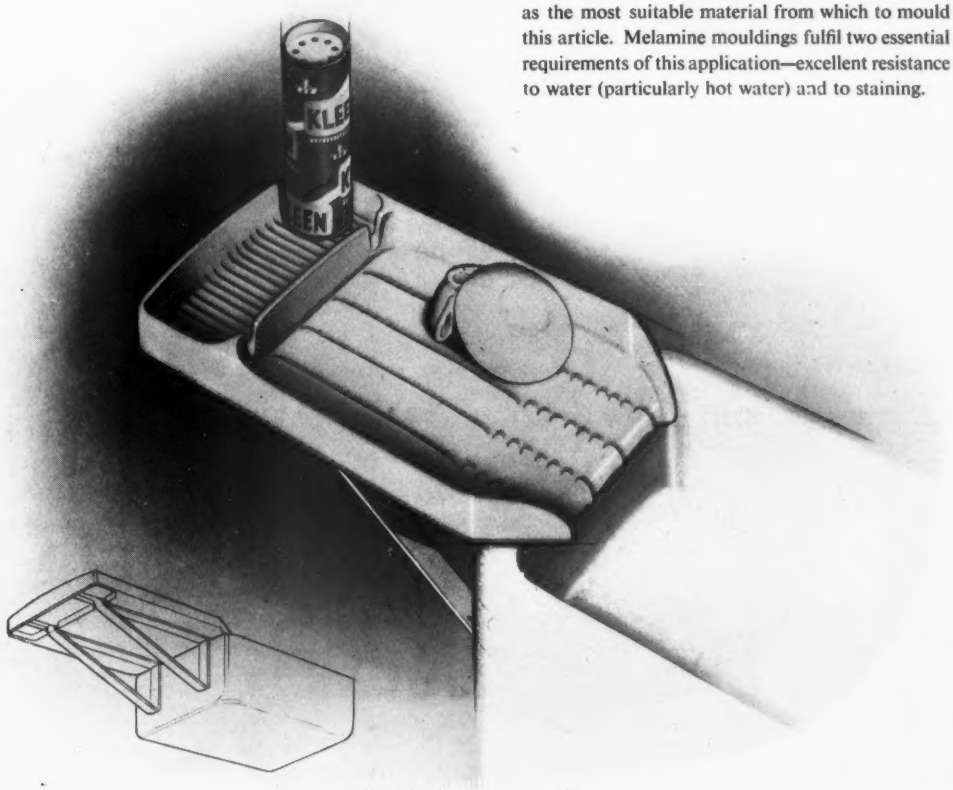
The Design. The following are the main points of interest:

Rigidity. The deep sides, apart from their functional requirement, also impart sectional rigidity to the moulded form.

Fixing. Constructionally, the moulding is not rigidly fastened to its metal support brackets, but is simply positioned by lugs on its underside. This provides a firm fixture, but allows the moulding to expand or contract freely—a safeguard against stresses and strains that might otherwise occur.

Drainage. The built-in compartment drains from two slots into a channel running right round the main board. This prevents the soapy water from coming into contact with articles already washed or dried.
The front lip, besides providing good drainage into the sink, also shrouds a locking device in each fixing bracket. These are sufficiently adjustable to enable the unit to fit any sink.

The Material. Beetle Melamine is recommended as the most suitable material from which to mould this article. Melamine mouldings fulfil two essential requirements of this application—excellent resistance to water (particularly hot water) and to staining.



Diagrammatic sketch to illustrate method of fixing.

The B.I.P. Technical Advisory Service is always ready to help moulders in any problem which may arise regarding product design, mould design, materials and moulding techniques. This consultative service is freely offered, without obligation, and applies to moulding in thermoplastic as well as thermosetting materials.

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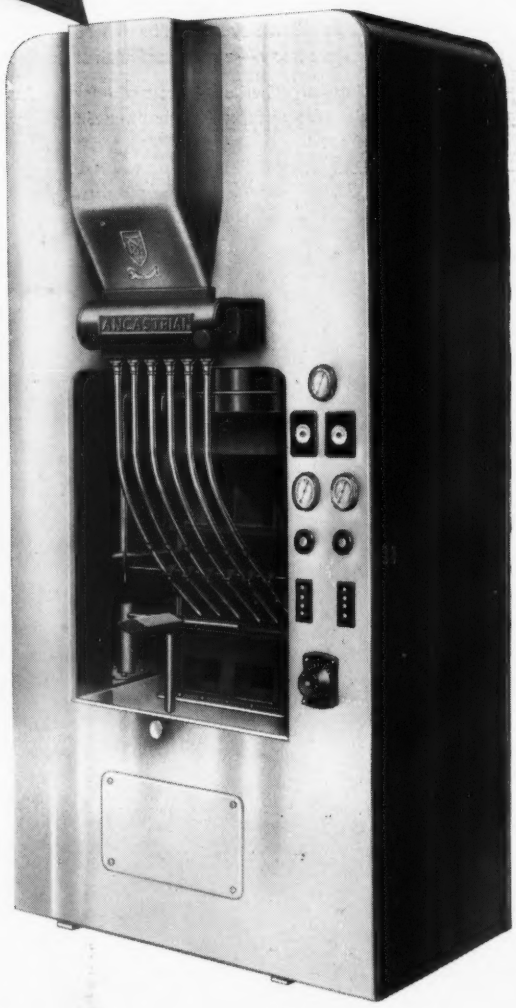

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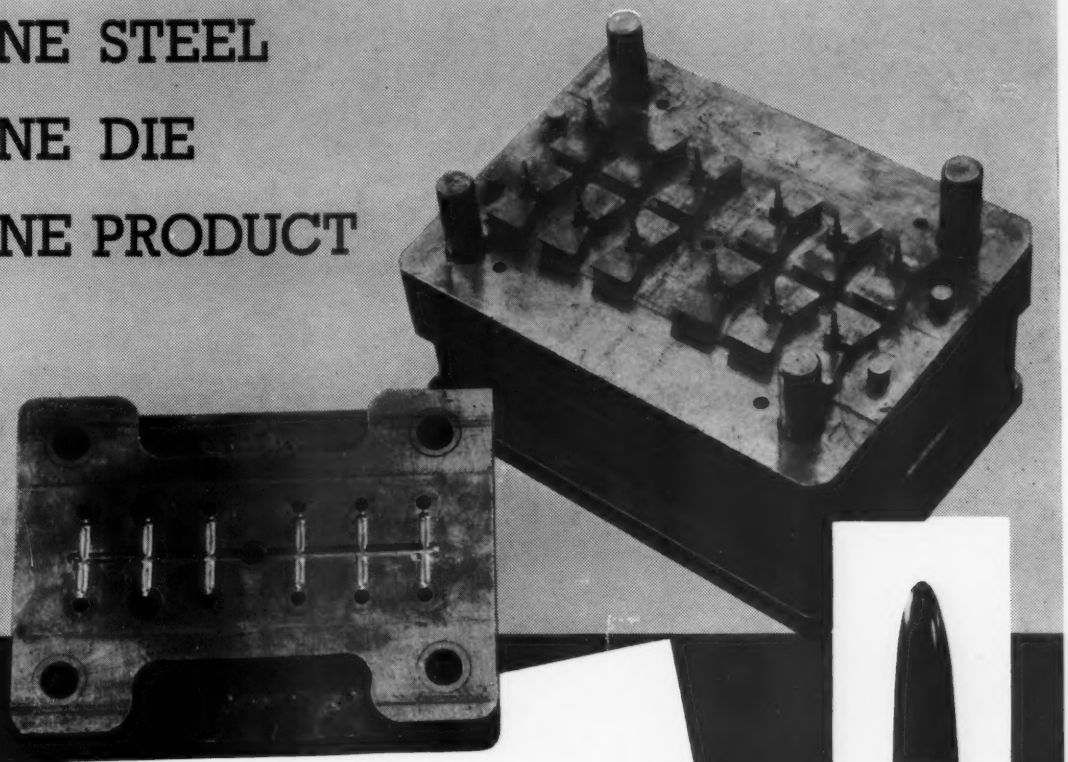

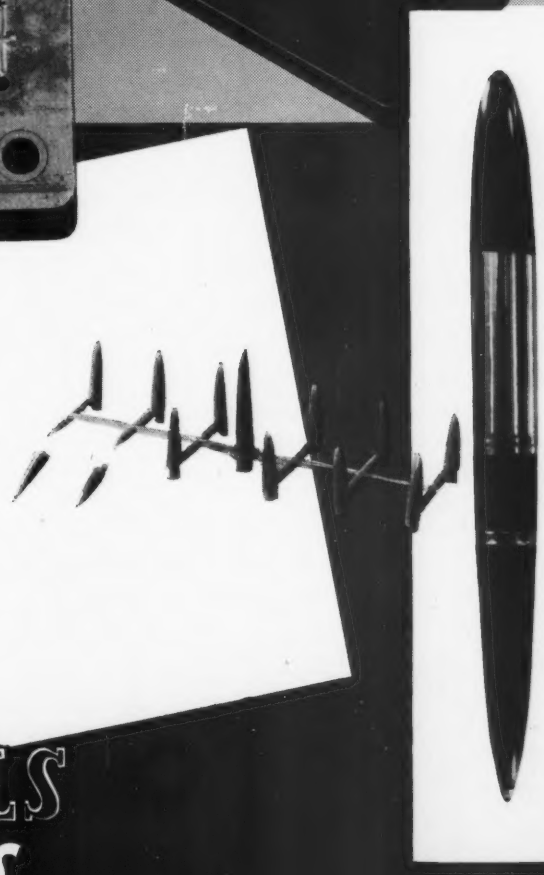

Mould for producing the end of a Ball-point Pen made in Firth Brown Nitralloy Steels—"LK3" Steel for core pin and "HCM7" Steel for sprue bushes. Photograph by courtesy of The Metal Products Ltd.

DIE STEELS for PLASTICS

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In course of time our venerable ancestor Wung-Li Ferg-Sun found that sending his products in rockets over the Great Wall of China (as mentioned in our last announcement) was an uneconomical proposition.

Hearing, also, that Japan was in desperate need of Shock-proof Building Materials—due to recurring earthquakes—he decided to become an " Invisible Export ". So, packing himself and his Plant in a Powder Drum, he was rocket-propelled to Japan.

He landed in Yedo (now called Tokio) which had just suffered its 153rd earthquake in seven months, the devastation being so great that the Emperor was on the point of committing hara-kiri.

Assembling his Plant, Wung-Li was soon producing prodigious quantities of his High Impact Shock-Resisting Powders for builders to mould into parts for buildings, which subsequent earthquakes failed to uproot and which are still standing to-day.

Thus Wung-Li Ferg-Sun solved that eternal question of the ancients—" *What happens when an irresistible force meets an immovable object* ". His shock-resistant edifices provided the answer.

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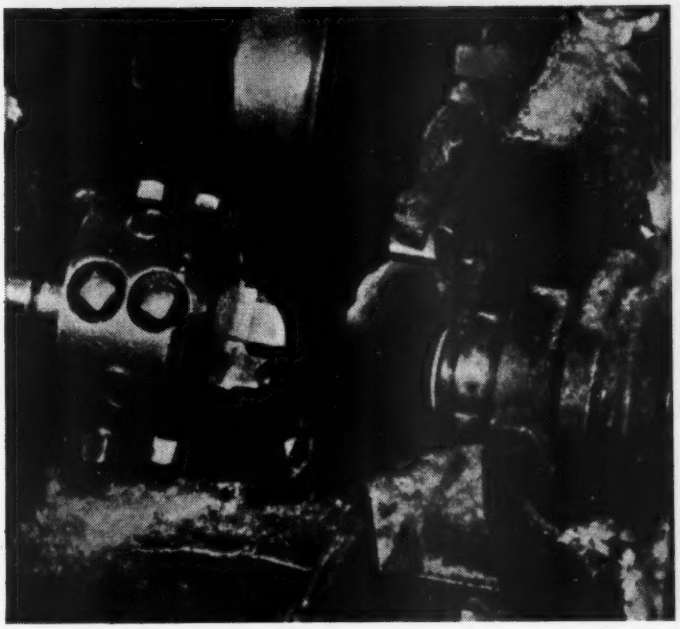
Thank Wickman for Wimet

Button-makers applaud tool performance



Vegetable ivory, used in the button industry, is machined with Wimet trepanning and forming tools, cutting continuously for eight hours, during which time 14,000 button blanks are produced.

A dull cutting edge would dislodge the blanks, which are held only by air suction against hard rubber pads. The second operation is carried out with two tools, one used for producing a concave form, the other for forming the rim.

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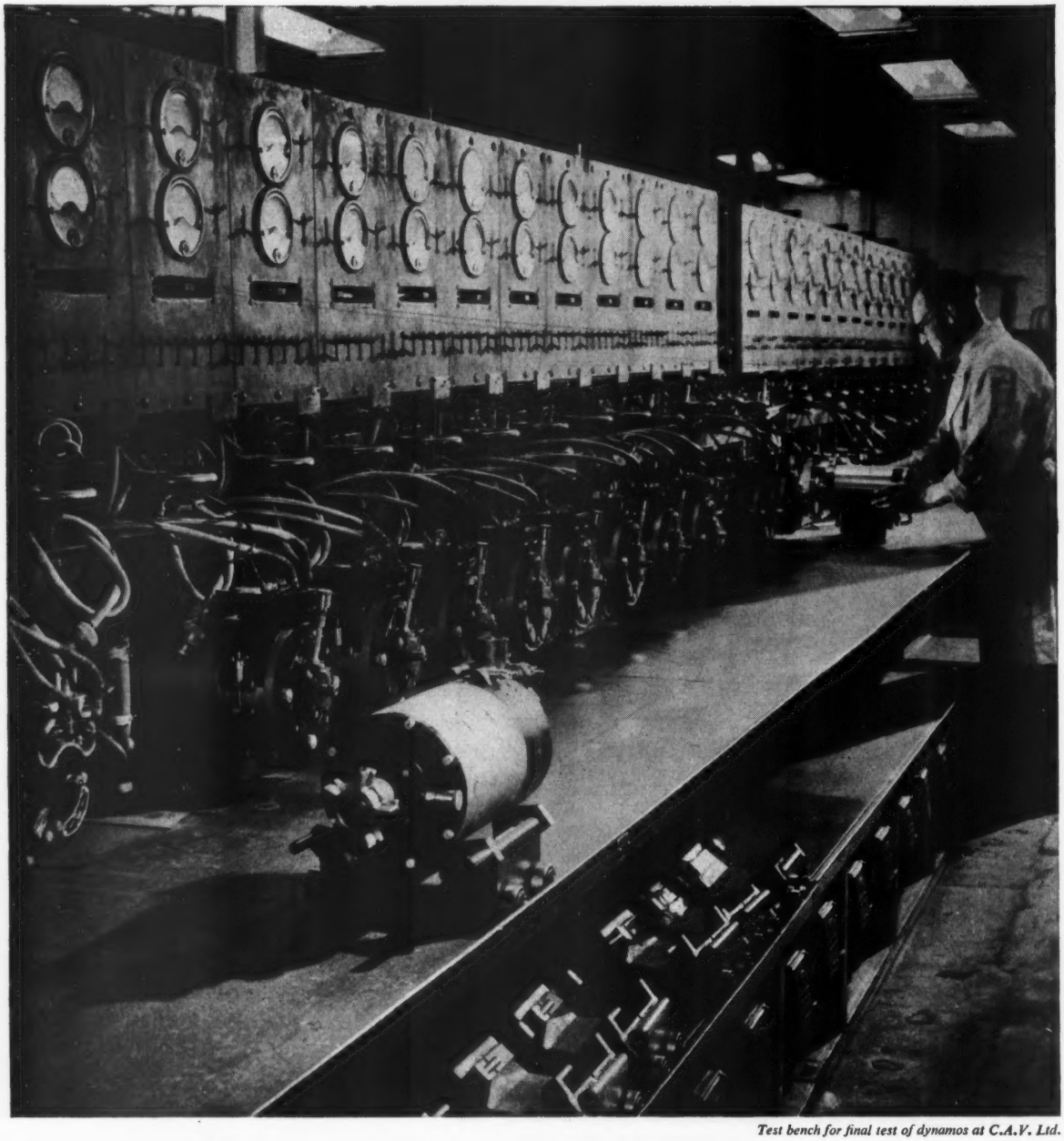

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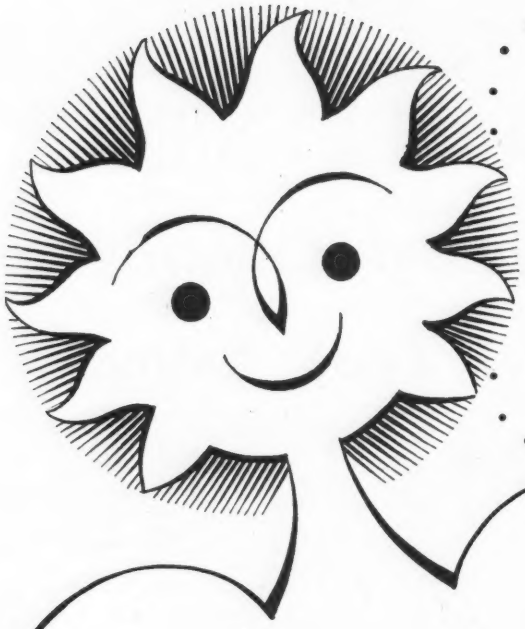

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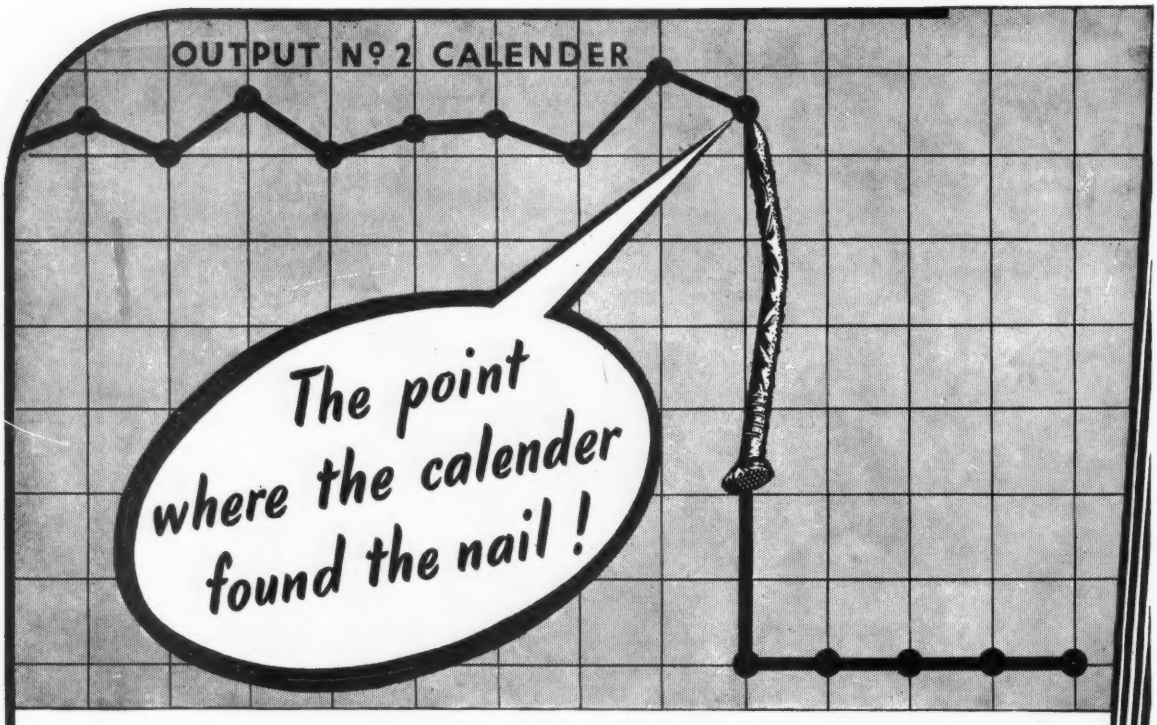

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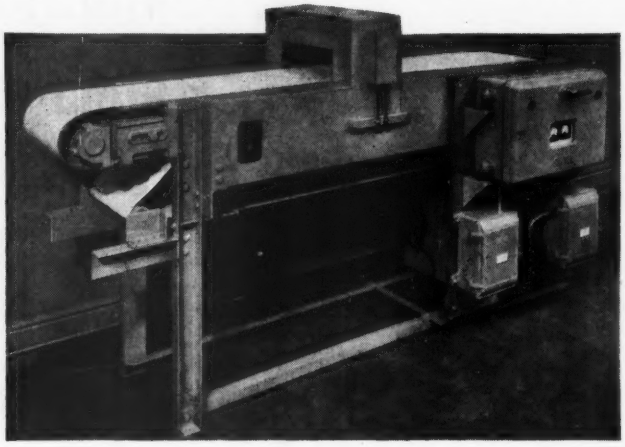

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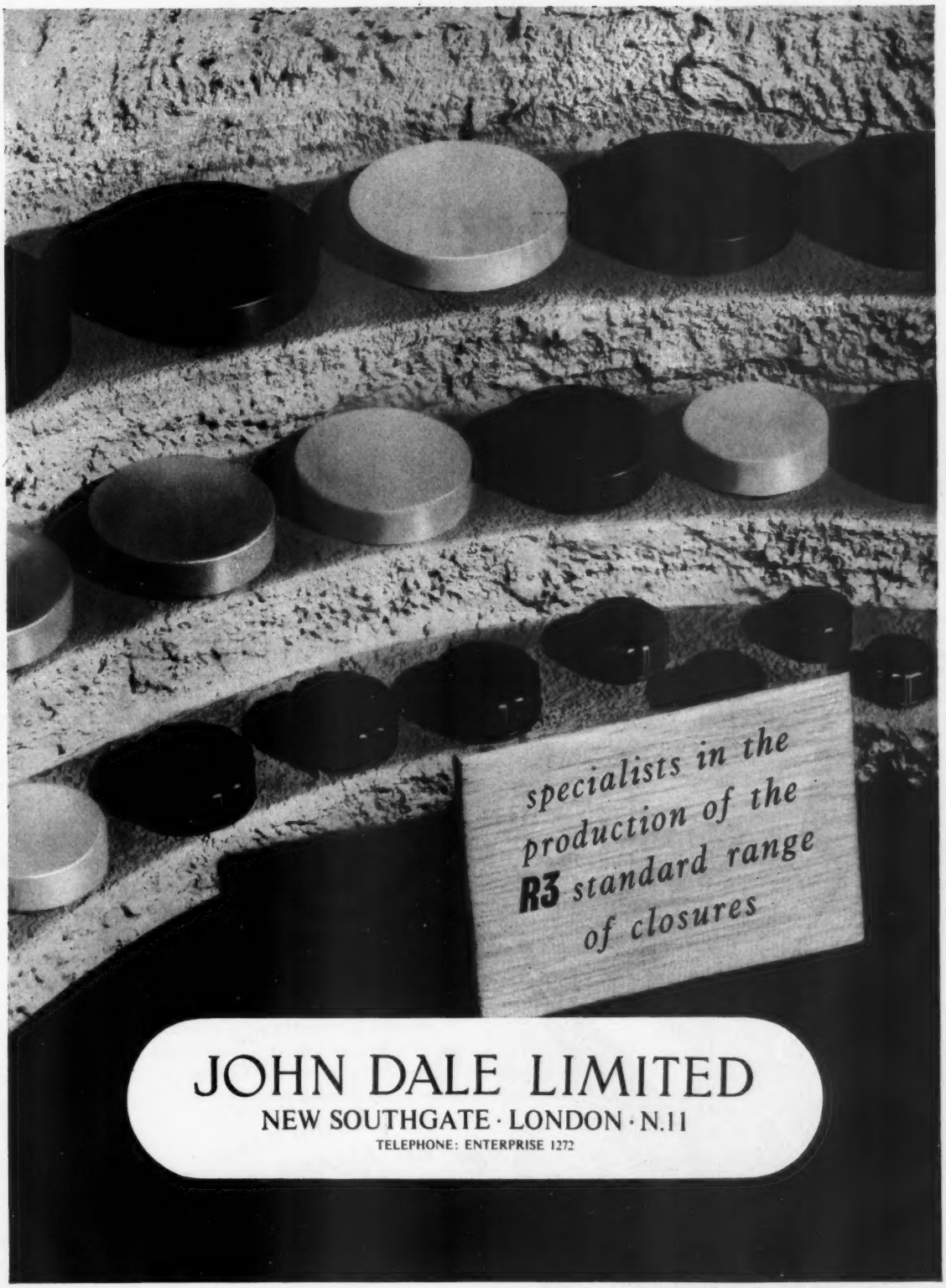
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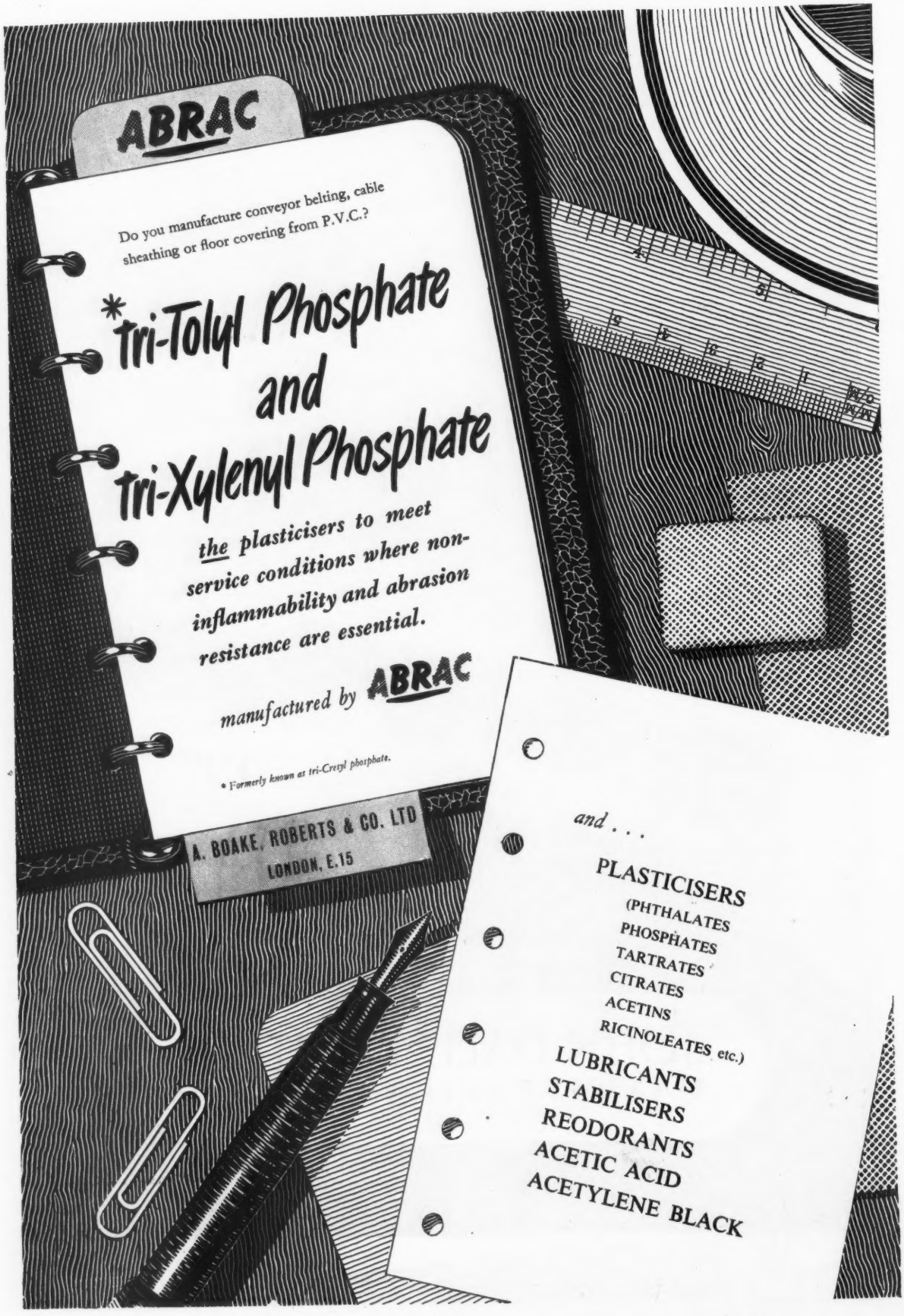
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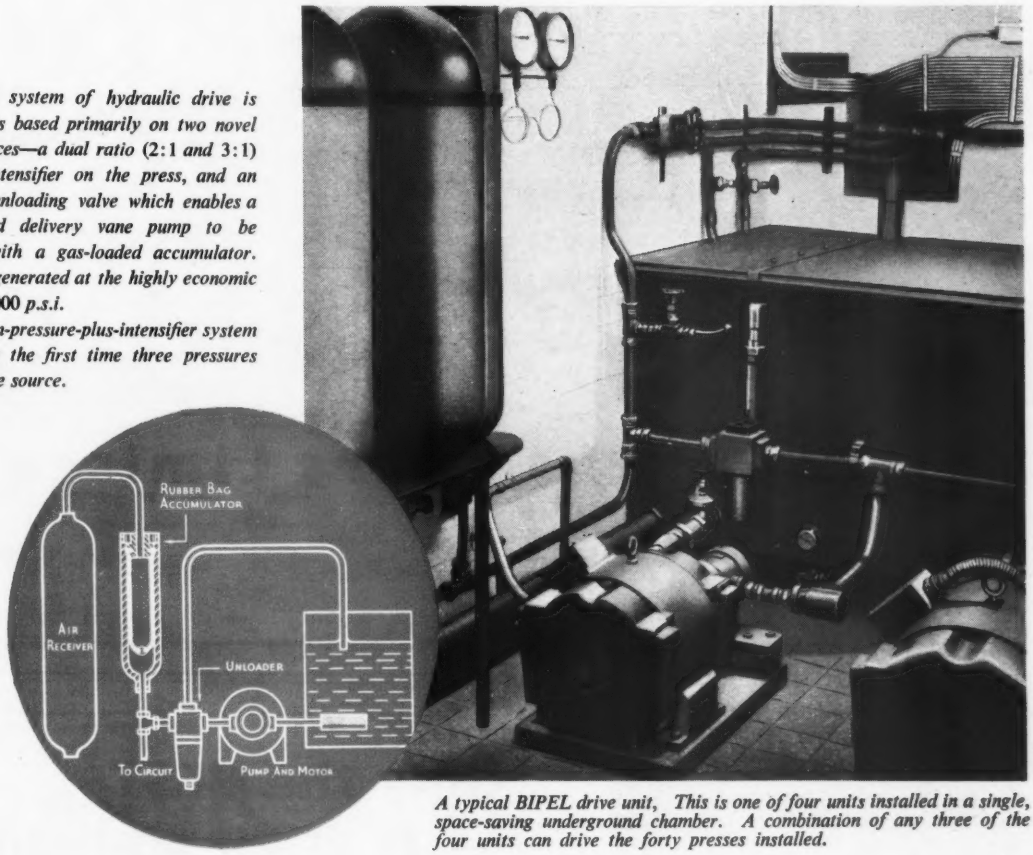

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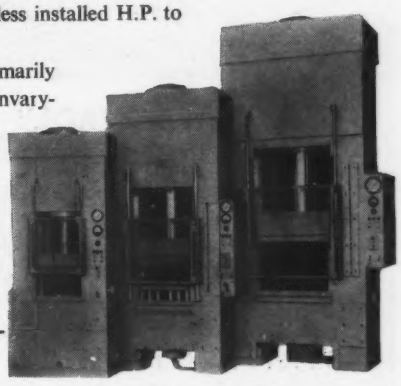

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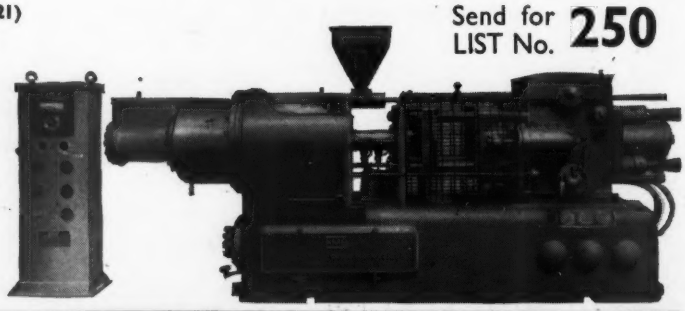

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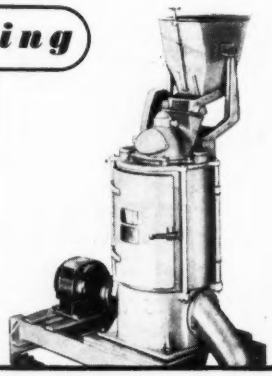

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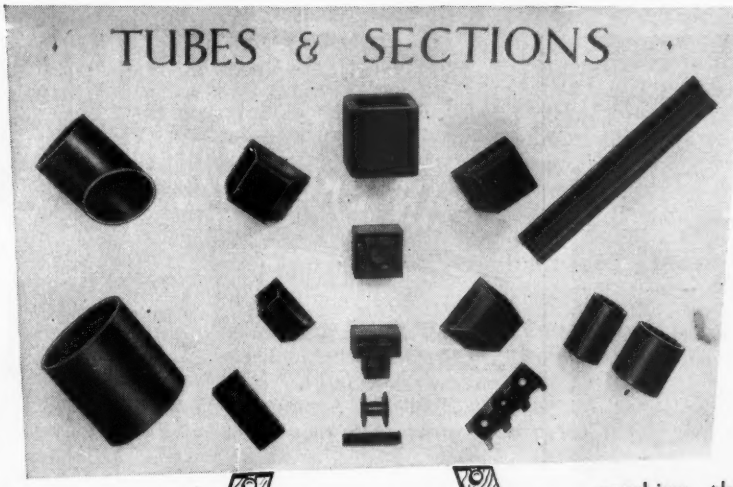

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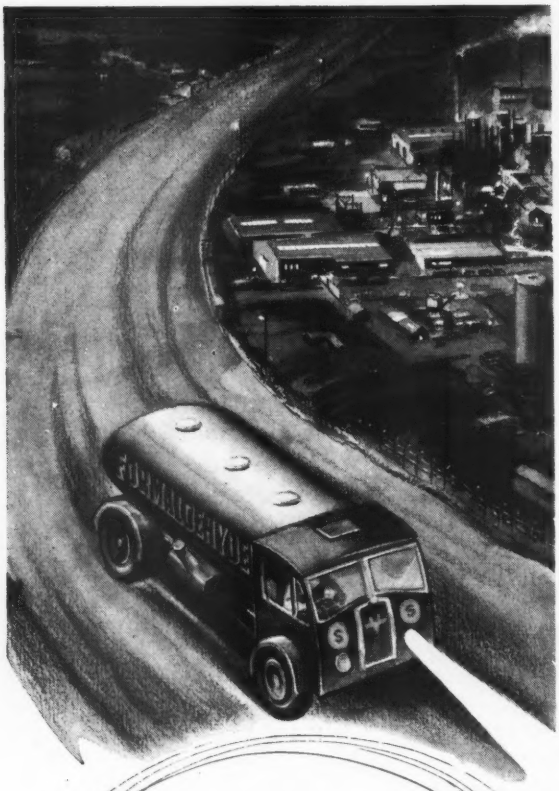

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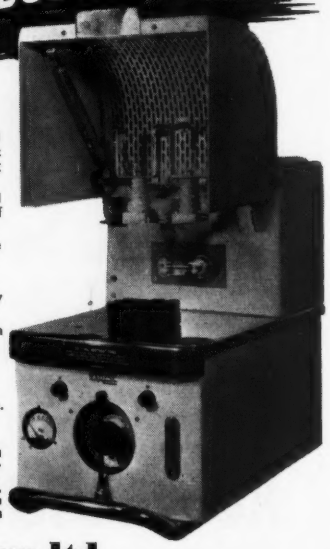

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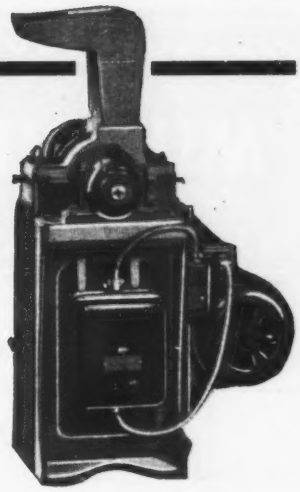

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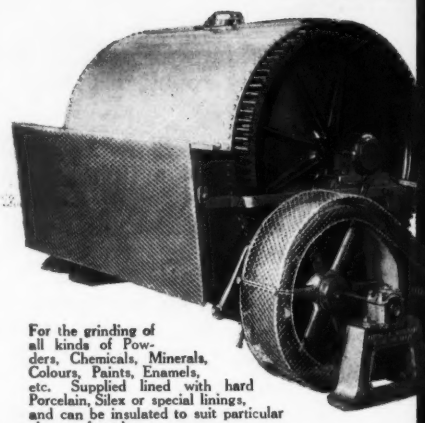

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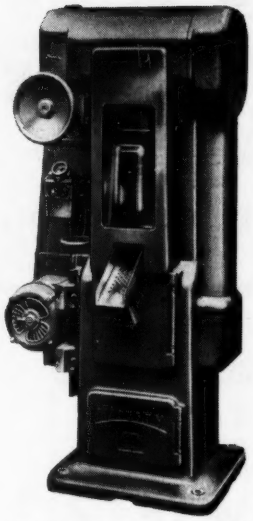

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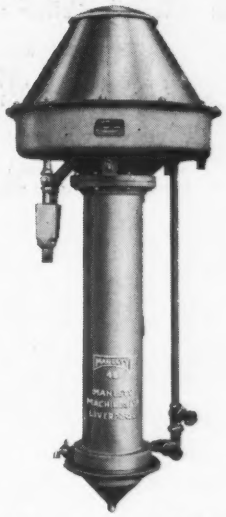

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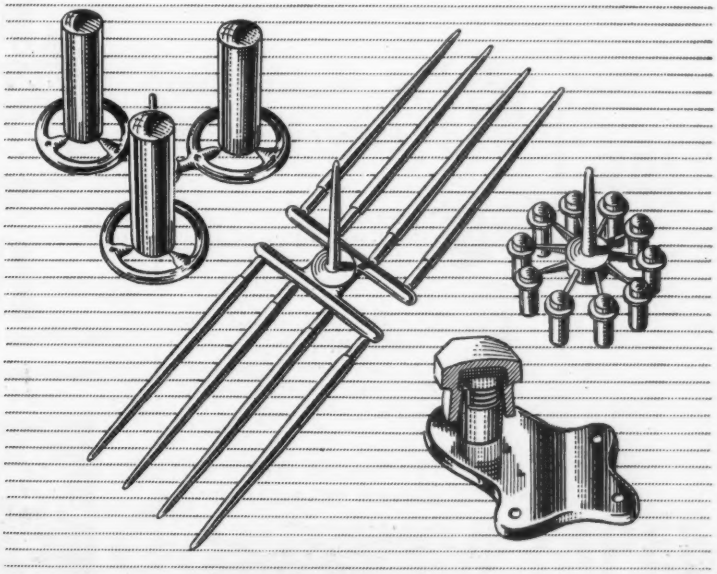

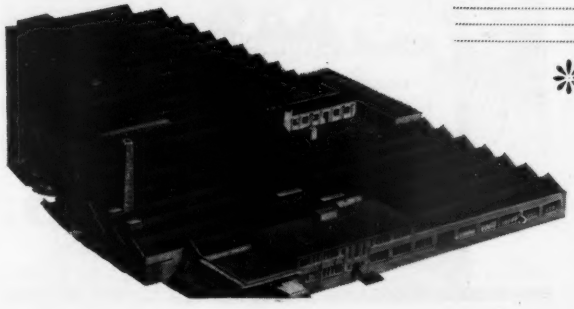

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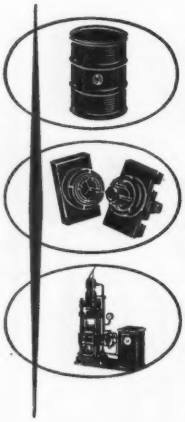

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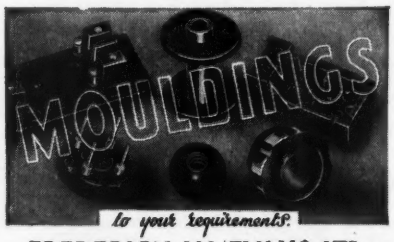

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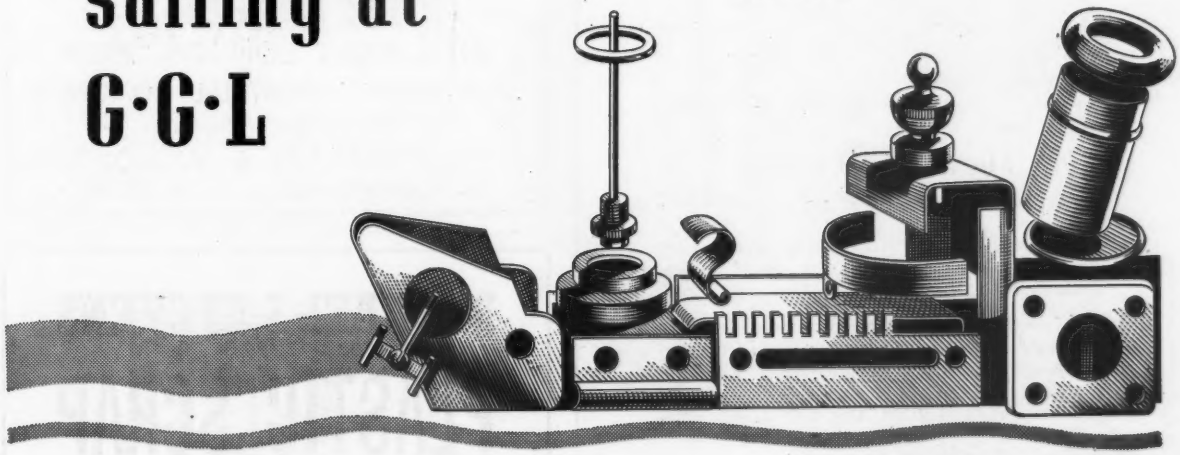

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INDEX TO ADVERTISERS

Name	Page
A	
Albright & Wilson, Ltd.	63
Allspeeds, Ltd.	12
Almex, Ltd.	75
Ashdowns, Ltd.	55
Asmidar Plastic Moulding Machines, Ltd.	33
Associated Lead Manufacturers, Ltd.	53
B	
Bakelite, Ltd.	38
Barber & Duffy, Ltd.	72
B.I.P. Engineering, Ltd.	59
Birkby's Ltd.	9
Blackfriars Rotary Cutters, Ltd.	67
Blagden, Victor, & Co., Ltd.	64
B.L.C. (Exports), Ltd.	74
Boake. A., Roberts & Co., Ltd.	58
Bradley & Turton, Ltd.	25
Bridge, David, & Co., Ltd.	36
British Electrical Development Association	52
British Geon, Ltd.	3
British Industrial Plastics, Ltd.	47
British Moulded Plastics, Ltd.	40
British Oxygen Co., Ltd., The	21
British Resin Products, Ltd.	27
BX Plastics, Ltd.	Inside Front Cover
Byson Appliance Co., Ltd.	70
C	
Calderon, M., Ltd.	74
Castle, John, & Co., Ltd.	72
Chamberlain & Willows	74
Cinema-Television, Ltd.	56
Cohen, George, Sons & Co., Ltd.,	61
Cole, R. H., & Co., Ltd.	19
Courtaulds, Ltd.	Front Cover
Crompton Parkinson, Ltd	13
Crystalate, Ltd.	26
D	
Dale, John, Ltd.	57
Daniels, T. H. & J., Ltd.,	11
Davis Bros. (Metal & Plastics), Ltd.	70
Derwent Plastics, Ltd.	41
E	
E.M.B. Co., Ltd.	4
Erinoid, Ltd.	Back Cover
Ether, Ltd.	60
Evans, Frederick W., Ltd	72
Evode, Ltd.	66
F	
Ferguson, James, & Sons, Ltd.	50
Finney Presses, Ltd.	63
Firth, Thos., & John Brown, Ltd.	49
Foster, Yates & Thom, Ltd.	48
Fraser & Glass, Ltd.	16
G	
Gardner, Wm., & Sons (Glos.) Ltd.	2
Gas Council, The	54
Geigy Co., Ltd., The	8
General Electric Co., Ltd., The	5 & 24
Gosheron, John, & Co., Ltd.	71
Griffiths, Gilbart, Lloyd & Co., Ltd.	73
Grist Plastics, Ltd.	34
H	
Haigh, John, & Co., Ltd.	68
Harris, Alfred, & Co. (Richmond) Ltd.	61
Hellerman, Ltd.	73
Herbert, Alfred, Ltd.	11
Hess Products, Ltd.	28
I	
Imperial Chemical Industries, Ltd.	Inside Back Cover
Industrial Plastics, Ltd.	70
Insulation Equipments, Ltd.	20
Insulators, Ltd.	18
K	
Kent Mouldings	75
L	
Lacrinoid Products, Ltd.	15
Lavino (London), Ltd.	6
Leaver & Hildrick	70
London & Scandinavian Metallurgical Co., Ltd.	78
M	
Manesty Machines, Ltd.	69
Marshall, C. & C., Ltd.	78
M.C.M. (Tools), Ltd.	74
Melwood Thermoplastics, Ltd.	10
Micanite & Insulators Co., Ltd, The	32
Miltoid, Ltd.	68
Monsanto Chemicals, Ltd.	30 & 31
Myers, M., & Son. Ltd.	69
N	
Nu-Swift, Ltd.	70
P	
Pascall Engineering Co., Ltd., The	64
Plastic Engineers, Ltd.	60
Plastomatic, Ltd.	29
Projectile & Engineering Co., Ltd., The	17
Punfield & Barstow (Mouldings), Ltd.	45
Pure Chemicals, Ltd.	46
R	
Radio Heaters, Ltd.	66
Reliance Trading Company	72
Resinoid & Mica Products, Ltd.	65
Riley Stoker & Co., Ltd.	35
Rootes Mouldings, Ltd.	37
Rubber Improvement, Ltd.	67
S	
Sale, H. B., Ltd.	62
Scott Bader & Co., Ltd.	65
Shaw, Francis, & Co., Ltd.	44
Smith, Stanley, & Co.	71
Spicers, Ltd.	72
Steele & Cowlishaw, Ltd.	68
Sterling Moulding Materials, Ltd.	46
Stevens, Michael S.	74
Sykes Machine Tool Co., Ltd.	22
Synthite, Ltd.	66
T	
Thermo-Plastics, Ltd.	7
Tullis Russell & Co., Ltd.	43
U	
U.K. Plastics, Ltd.	64
United Ebonite & Lorival, Ltd.	23
Universal Tools, Ltd.	1
Utilex, Ltd.	62
W	
Whiting, L., Ltd.	70
Wickman, Ltd.	51
Wiggins Teape & Alex. Pirie (Sales), Ltd.	14
Windsor, R. H., Ltd.	42

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